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China Report

SCIENCE AND TECHNOLOGY

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CHINA REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

CHINA SETS UP PATENT SERVICE NETWORK

Beijing RENMIN RIBAO in Chinese 15 Mar 84 p 2

[Text] China has taken steps to set up a patent service network with the National Patent Office as its center.

After the National Patent Office was established in 1980, patent branch offices or agencies have been successively set up in Shanghai, China's chief industrial city, as well as in the provinces of Liaoning, Shandong, and Hunan. The patent work in other provinces, municipalities, and autonomous regions is assumed mostly by the area science and technology committees.

Some areas have even set up organizations like research conferences into industrial property rights and service centers for consultation on patent documents. They have also taken up patent learning exchange activities at a mass level to translate foreign science and technological materials for customers and to provide patent consultation services, etc. Since 1979, relevant departments of the central government and all provinces and cities have held 79 patent knowledge study groups.

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S&T LEADING GROUP FORMALLY ESTABLISHED

Wuhan HUBEI RIBAO in Chinese 17 Jul 84 p 1

[Article: "The Hubei Provincial Government Formally Establishes an S&T Leading Group--Huang Zhizhan [7806 4249 4176] Presides Over The First Meeting To Discuss the Primary Tasks of the Group"]

[Text] In order to strengthen leadership of S&T work, the Hubei CPC Committee and Government decided to establish a Science and Technology Leading Group in the Hubei Province People's Government. Governor Huang Zhizhen is the Group Chairman. Deputy Secretary of the Hubei CPC Committee Qian Yunlu [6929 6663 6922] and Vice Governor Liang Shufen [2733 3219 5358] are Deputy Chairpersons. Responsible comrades in nine related departments, including the Science and Education Department of the Hubei CPC Committee, the Hubei Science Commission, the Economic Commission, and the Planning Commission are members of the group. The Leading Group Office was set up in the Hubei Science Commission. The Director of the Hubei Science Commission is the Director of the Office, and the Deputy Director of the Science Commission is the Deputy Director of the Office.

Recently, Huang Zhizhen presided over the first meeting of the Hubei Science Commission S&T Leading Group and discussed the primary tasks of the S&T Leading Group and the primary responsibilities of the S&T Leading Group Office.

The primary tasks of the Hubei Science Commission S&T Leading Group are: 1) To adhere to the directions and policies of the Central Committee concerning S&T work, and to integrate actual research for determining the significant measures and steps for science and technology in Hubei. 2) To unify leadership and prepare provincial S&T development plans, including plans for transforming professions and key enterprises and products, and plans for major imports of technology. 3) To unify leadership and plan reform work in the provincial S&T system. 4) To study and make decisions on major technical policies in the province, special policies on the importation and circulation of skilled persons, and on the importation and digestion of major technologies. 5) To coordinate and guide S&T work in all areas, on all fronts, and in all departments, and to coordinate and organize the main S&T forces to gear themselves to economic construction and concentrate forces to tackle key S&T problems.

Seven decisions were also made in association with the primary responsibilities of the S&T Leading Group Office.

The Leading Group also studied and discussed work for the formulation of S&T plans for the province and the question of work for technological transfers through the "transfer from the military to the civilian sector", and arranged for the Hubei Science Commission to prepare to draft a "Program for Personnel Circulation" for discussion during the next meeting of the group.

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NATIONAL DEVELOPMENTS

CONTRACT SYSTEM FOR HIRING S&T PERSONNEL

Beijing RENMIN RIBAO in Chinese 31 Jul 84 p 3

[Article by Wang Kang [3769 1660] Director of the Board of the Chinese Personnel Research Society: "Trial Implementation of a Contractual Hiring System for S&T Personnel under Plan Guidance"]

[Text] Premier Zhao pointed out in his "Report on Political Work" at the Second Meeting of the Sixth People's Congress that "we must reform the administrative system for scientific and technical personnel and specialized cadres, promote the rational circulation of talented persons and achieve a situation where everyone can make use of their talents." How can the reforms be made? We feel that it is definitely feasible to begin gradually implementing a contractual hiring system under plan guidance.

A contractual hiring system under plan guidance combines state plan requirements, the voluntarism of units, and certain rights of individuals to select a work unit, and it rationally adjusts the three-sided relationships among the state, units and individuals in the question of personnel allocation. A contractual hiring system under plan guidance embodies the principle of combining plan guidance with social regulation, and it is suited to China's socialist economic system.

In essence, the contractual hiring system means that the hiring unit contracts to recruit S&T personnel, and the S&T personnel also use the contract to accept a position at a unit. The hiring unit has the right to take on and dismiss employees, while individuals have the right to accept or decline offers. Both parties must scrupulously abide by the contract. Contracts are signed through discussion by both parties within the scope of related state policies and decrees. The contract specifies the responsibilities, rights and benefits of both parties, the time limit of the contract, and so on. It can be renewed when it expires if both parties agree. The adoption of a contractual hiring system can maintain work stability for units and individuals during the period of the contract, and it also can open up channels for the movement of personnel. This is basically identical to, or different in name from but the same in actuality as, the trial recruiting system used in

some areas and units. However, it is different from the method of advertising vacancies that is now used in some medium and small cities. The latter has not fundamentally broken through the problem of the "department and unit ownership system." Of course, the method of advertising vacancies benefits the movement of personnel and still is quite important at present.

The contractual hiring system is not the same as the appointment system in capitalist countries. Because our contractual hiring system is basically suited to the related state policies and decrees, and comes under guidance by state plans, it cannot become the free circulation found in capitalist countries.

How should guidance by the state plan be carried out? At the macrolevel, they should be strictly managed and managed well. At the microlevel, there should be a direction of opening up and making things dynamic. I feel that we should at least adopt the following policies and measures:

The method of planned allocation or of integrating planned allocation with contractual appointments can be adopted for S&T personnel needed by the state for its enormous economic construction projects and massive scientific research projects. Those S&T personnel who come under planned allocation should conform to the needs of the state.

There should be personnel circulation in a rational flow for a certain period of time as decided by the state. Contracts not suited to the flow cannot be signed, and will be treated as illegal. Those persons with special considerations must receive approval from leadership organs before they can sign a contract and go against the flow.

As for college graduates, apart from those directional enrollees who return to their original units, there should be planned allocation in order to guarantee theneeds of developing the state economy. College students who conform to the state allocation should not sign contracts for appointments until they have served at least 3 years. Of course, those with the wrong specializations can be readjusted as needed. Those students who went abroad with public expenditures are basically the same as university graduates.

All units, especially those institutions of higher education, research institutes, design units and some large enterprises, should carry out fixed arrangements, fixed personnel and fixed personnel ratios. They should advertise a position if there are shortages. This is a prerequisite for implementing a contractual hiring system.

As for personnel that have not yet been recruited, the state will take care of them temporarily, pay them a basic wage, and even introduce work through several channels and forms. It will carry out training, develop S&T services and social services, and even give them a certain amount of remuneration. Later, there will be a gradual transition to social insurance or other methods. The main thing is that they should have something to eat.

EXPERIENCE OF SHANGHAI UNITS DISCUSSED

Beijing RENMIN RIBAO in Chinese 31 Jul 84 p 3

[Article: "Some Units in Shanghai Are Trying a Contractual Hiring System for S&T Personnel--Interference with the Circulation of Personnel Will Be Dealt With Through Administrative Intervention"]

[Text] According to a report in the WENHUI BAO, the Scientific and Technical Cadre Office of the Shanghai Municipal Government has Decided to try out an S&T personnel hiring system.

After responsible persons for technology at all levels have been hired, units trying the hiring system organize free topical groups or project groups led by persons responsible for technology. The units have the right to appoint or dismiss employees, and the S&T personnel have the right to accept or decline an appointment. All technical personnel that are given appointments should receive an employment certificate from the plant (or institute) director. The certificate of employment should specify the time period of the appointment and clearly show the rights and responsibilities of the employees. The plant (institute) director has the power to increase the wages, bonuses and allowances of appointed personnel according to their technical level and position, as well as according to the size of their contributions. The units trying the hiring system have the power to recruit needed S&T personnel from other units, and they also have the power to refuse to accept S&T personnel unsuited to the work of the unit.

The length of appointments for S&T personnel is generally 2 or 3 years. Unless both parties agree, no contract should be abrogated during the period of the appointment. The state can make direct reallocations by breaking the hiring contracts of any S&T personnel that are urgently needed in key construction projects of the state and the city of Shanghai.

The trial method stipulates that after completing the tasks specified in an appointment contract and with agreement by the leadership, S&T personnel can be permitted to take up conconcurrent posts in other units and engage in consulting services and activities. Moreover, they should receive a rational remuneration for their labor.

For S&T personnel that have not received appointments, the original unit should continue to be concerned about them and make appropriate arrangements to give play to their skills.

Another report. According to the JIEFANG RIBAO, foreign trade units in Shanghai Municipality recently have been openly recruiting personnel within the city. Some units are resisting without reason and not allowing the people to go. The city Personnel Bureau arbitrated and decided to continue carrying out administrative intervention in certain units with similar attitudes about personnel circulation.

Xu Guoping [1776 0948 1456], an employee in a company under the Shanghai Municipal Textile Industry Bureau, graduated from the bureau's employee university with a specialization in foreign trade. He was involved in materials supply work, however, and had no use for his studies. Xu found a job during the open recruitment by foreign trade units, but his original unit refused to let him go. In response, the city Personnel Bureau issued a transfer order and an urgent transfer order, but the original unit paid no heed. On 21 June, the Cadre Allocation Department of the city Personnel Bureau notified the unit that if it still refused to let him go after 3 days, they would adopt measures for administrative intervention. On 24 July, the unit finally agreed to let Xu Guoping report to the foreign trade unit.

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NEW TECHNICAL REVOLUTION AND INSTRUMENTS

Beijing RENMIN RIBAO in Chinese 9 Aug 84 p 5

[Article by Guo Zhijian [6753 1807 1017], Zhu Liangyi [2612 5328 3354] and Ma Shaomei [7456 1421 2734]]

[Text] An important indicator of a new technical revolution on a world scale is that information technologies have developed by leaps and bounds. There are three technical aspects of information technologies: computing techniques, communications technologies, and measurement and control technologies. The first two types are for solving problems in information processing and transmission, while measurement and control technologies resolve problems in collection information and implementing controls. Through the entire process, from information collection, processing and transmission to control, the basic technology is measurement and control technology. The material means of these three types of technologies are computers, communications equipment and instrumentation. These three form the information measurement and control system. It can be seen that instruments such as computers and communication equipment are extremely important in the new technological revolution.

Instruments have a high degree of technical intensity, and also are the sphere of industry most sensitive to the application of new technologies. For this reason, people have termed the instrumentation industry the "knowledge industry". Modern instruments centralize the application of various new technologies and theories such as microelectronic technologies, laser technologies, superconduction technologies, optical fiber technologies, sensing technologies and control theories, and various types of new materials and components. New technologies make broad use of instruments, and they are continually being updated and replaced. An example is the use of electrically-powered modular instruments for automatic monitoring and for measurement and control in industrial production. They have gone through four generations of updating in less than 30 years, from the vacuum tube to transistors to integrated circuits and on to medium and large scale integrated circuits. The sphere with the earliest and greatest application of microprocessors is in instrumentation. According to statistics, about 37 percent of microprocessors are being used in instruments. For this reason, instruments are the broadest market for application of the newest science and technology.

Instruments are becoming increasingly essential in modernized economic construction. An example is modernized power plants. All of them require large capacity, highly efficient, automatic monitoring and control and benefit accounting management. During the 1960's, power stations maintained normal operation by measuring and controlling only several hundred parameters such as temperature, voltage, current, liquid levels, electric quantities, mechanical quantities, and component quantities. During the 1970's, the number of parameters needed for measurement and control increases to more than a thousand. In the 1980's, a modernized power station needs nearly 10,000 measurement and control parameters. Moreover, the degree of automation is becoming increasingly higher. There has been comprehensive automation, from control and maintaining interlocking in the production process to improved management. This requires the use of many types of instruments, industrial controllers and automated equipment, and makes even higher demands in the area of instrument functions and reliability.

Technical transformation for the purpose of improving economic results in several hundred thousand enterprises is a strategic measure for invigorating the economy. Taking a medium-sized integrated steel foundry as an example, 16 percent of total expenditures for technical transformation were used to purchase instruments and automated equipment. Some 20 percent of the equipment structure in a modernized electronic products plant is instrumentation. In the structure of labor time for a product, 20 percent is used for measurements. These statistical figures show that instruments play an enormous role in the technical transformation of an enterprise.

In the past, most of the machine products in China were machines, with a small amount of additional electrically powered or simple switching control equipment. Electronic technologies were introduced in the1960's, and a large number of technical products that integrated machines and electronics were produced, raising the level of technical equipment a great deal. Since the 1970's, it has been necessary to apply advanced measuring and control technologies for the production of products that integrate machines, electronics and instruments. This was the so-called integration of machines, electronics and instruments. Such things as programmable numerically-controlled machine tools, intelligent robots, and highly automated high-speed continuous rollers adapted to soft production are representative examples. For this reason, instruments should be at the forefront of developments in the machine industry.

Instruments are now being widely used in all spheres of the national economy, and the scope and depth of their use is growing continually. Some people have likened instruments to a "catalyst" in scientific and technical development and an "accelerator" in the take-off of the national economy. For this exact reason, industrially developed nations have always made the instrumentation industry the leader in industrial development. Scientific research and production of instruments in China still cannot meet the urgent needs of construction of the four

modernizations. China has many excellent S&T workers with very high intellectual and teheoretical levels. Due to the lack of measures for testing and verifying advanced technologies within the country, however, the result has been that many highly creative ideas and designs cannot be tested, verified and achieved through the appropriate scientific experiments, and it has been difficult to achieve creative S&T results. This situation must be turned around or it will be very difficult for us to jump into the advanced ranks of world S&T. For this reason, we should acknowledge the seriousness and urgency of this question and adopt truly effective measures to speed up research and production of instruments.

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SONG JIAN ON REFORM OF LEADING ORGANS, IMPACT OF NEW TECHNICAL REVOLUTION

Beijing GUANGMING RIBAO in Chinese 18 Aug 84 p 1

[Article: "Song Jian [1345 0256], Secretary of the Party Group of the State Science and Technology Commission Says that Reform of Leading Organs Must Pay Attention to the Impact of the New Technical Revolution--Reform Organizational Work Structures, Establish Professional Systems Analysis Departments, Establish an Information System with Computer Networks as the Core, Absorb Large Numbers of Technical Personnel"]

[Text] Recently, Song Jian [1345 0256], Secretary of the Party Group of the State Science and Technology Commission discussed the topic of "Systems Engineering and the New Technical Revolution" for cadres in the Central Committee and leaders of ministerial departments and bureaus in state organs and higher levels. He pointed out that, apart from giving consideration to policy factors in the current reform of leading organs, full attention also must be given to the influence of the new technical revolution on administrative work. For this reason, he also proposed that we should pay attention to three questions during the reform process: reforms in organizational work structures, establishment of an information system with a computer network at its core, and absorption of large numbers of technical personnel for participation in organizational leadership work.

The reform of organizational work structures involves mainly the establishment of an automated information system and professional systems analysis departments, or the further transformation of existing comprehensive planning bureaus for a specialized division of labor in information collection and synthesis, systems analysis and experimental policy design and simulation, establishment of new positions for economists, designers, engineers and others for systems analysis, information processing, policy simulation and other professions, so that organizational work is established on the basis of systems science and systems engineering. We should transform the intellectual structure of organizations and increase the proportion of specialized personnel in the above professions. Reduce personnel overlapping and transform the situation in which everyone is concerned with "important matters" but important matters have no one working on them. It is necessary for there to be suitable discussions and meetings, but we cannot treat conferences as a primary leadership method. What every department in an organization should contribute to the main leading cadres is data, facts,

analysis of conditions, developmental trends, and the policy measures and results of simulation experiments that can influence these developmental trends.

He felt that departments and committees that are the primary administrators of industry, agriculture, communications, transport, energy and other economic work should establish information systems with a computer network as their core. A systematic and active image of trends in the facilities and enterprises under a department should be established in the computer database. This will be of major importance for analyzing situations, trend forecasting and policy formulation in all areas of economic work. As problems in using Chinese characters in computers are solved, we should also establish an additional automated word and object processing system.

In order to achieve the reforms for modernization of the two administrative aspects described above, Song Jian emphasized that state organs and leadership organs in provinces, municipalities and autonomous regions should absorb large numbers of S&T personnel to participate in this work. There also should be a large number of workers in the natural sciences and the technical sciences to serve the social sciences and to serve state administrative work. This is an essential trend in the modernization of state management. Regardless of whether we are establishing systems analysis, policy simulation or automated information processing, all should have social science workers and technical science workers to personally cooperate to gain the desired results. This of course does not mean that technical personnel can replace older comrades with many years of administrative experience and profound and sensitive knowledge of the system under them, nor does it mean that the main leading cadres at all levels should be technical personnel. However, technical personnel are indispensable in establishing a systems analysis structure and an automated information system.

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GUANGDONG S&T PERSONNEL ALLOWED TO RESIGN, SEEK JOBS ELSEWHERE

Beijing GUANGMING RIBAO in Chinese 22 Aug 84 p 1

[Article: "Guangdong Province Allows S&T Personnel To Resign and Seek Jobs Elsewhere--New Measures To Resolve Problems of Wasted Knowledge, Unused Strong Points and Inappropriate Applications"]

[Text] Allow S&T personnel to resign and seek jobs elsewhere--this the newest measure adopted by the Guangdong Province People's Government to break down the system of unit ownership of personnel. For this reason, the Guangdong Province Personnel Bureau used Guangzhou City as a test point to convene a personnel exchange conference today. During the meeting, there were lively discussions for recruiting and recommending qualified people, as well as those recommending themselves. The number of units that set up files to recruit qualified people at the meeting increased from the originally planned 70 to 148. The conference announced that there was an urgent need for more than 23,000 persons with various specializations.

Currently, there is a personnel shortage in the S&T ranks in Quangdong Province, but there also are problems of overstaffing, waste and unused skills. Several measures were adopted in the past to change this situation, but with only minor results. Now, they have made the decision to allow S&T personnel to resign from their positions. It was decided that all specialized technical personnel who have had their initiative affected because of not being able to use their knowledge, not making use of their strong points, not being used appropriately, or for other reasons, have the right to ask to leave their original unit and seek a position elsewhere. The original unit can urge them to stay or advise them, but it cannot withhold them. If the original unit still does not make good use of the person or agree to release them, they can be permitted to resign with approval by the Guangdong Province or Guangzhou City Personnel Departments. Their original wage and job title should be maintained after resigning and moving to the new unit, and their seniority should be cumulative. The S&T personnel said happily that this is the first time the barriers to personnel circulation have been opened.

Other forms of personnel circulation during the meeting included adjustments through loaned personnel, soliciting appointments, taking on concurrent posts, contracting for tasks, technical cooperation, and so on. In order to maintain stability in the teaching ranks, teachers in middle and lower schools and vocational middle schools will not participate in the exchange this time.

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ENCOURAGE SCIENTISTS TO DEVELOP THEIR TALENTS

Beijing GUANGMING RIBAO in Chinese 22 Aug 84 p 2

[Letter to the Editorial Department From Reporter Zheng Haining "Many Scientists and Technologists Call for Encouraging Middle-Aged and Young Scientists and Technologists To Develop Their Talent as Early as Possible"]

[Text] "We should encourage middle-aged and young S&T personnel to rapidly "become top-notch". This was a strong appeal that this reporter heard from many S&T personnel during visits to several S&T departments.

According to an investigation of conditions in more than 30,000 S&T personnel in the Science Associations of 27 provinces, municipalities and autonomous regions, the number of scientists at internationally advanced levels in China at present amount to about 0.03 percent of the total number of people in the S&T ranks, and the number of excellent S&T personnel at advanced domestic levels amount to 0.2 percent of the total number of people in the S&T ranks. More than 90 percent of these excellent S&T personnel are middle-aged and young people. They are a "national representative brigade" in the S&T battlefront in China at present, and they are a backbone force in achieving the modernization of science and technology. For various reasons, however, their ranks still have not been completely organized. Some departments still do not guarantee their rapid development through systems and work conditions. Some excellent middle-aged and young S&T personnel are even been subjected to constraints and constant problems.

Zhao Dajun [6392 1128 7486], Shen Xiaodan [3088 2556 0030] and other research personnel in the Chinese Science Research Office said that middle-aged and young S&T personnel should be enabled to display their abilities and talents. Scorn among scholars of the same generation and the scholar-tyrant work style should be overcome. Moreover, we should eliminate interference arising from envy and jealousy toward worthy and capable people, and do away with the use of power to put pressure on talented people. They pointed out that we must break with convention, and not merely rely on chance, but pay attention to giving play to the role of institutionalizing found in science associations, academic societies and other organizations in all areas.

In the selection of middle-aged and young S&T personnel, several S&T personnel stressed that we must break down the concept of arranging generations according to seniority, and we should also overcome egalitarianism. Those excellent middle-aged and young S&T personnel who have displayed their abilities and talents should be provided with special working conditions and special treatment in living arrangements. Some people also said that many of the university and vocational middle school specialists who graduated during the "Cultural Revolution", making up 40 percent of the S&T ranks in China, have shown enthusiasm in taking up new subjects and working in the frontline of S&T, but that this S&T personnel reserve echelon, which comprises 80 percent of elementary S&T personnel, generally plays a relatively poor role. Facts have proven that if we do not concentrate on training, educating and improving this group of people at the present time, then it is quite possible that there will be an echelon personnel shortage ten years later.

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DEFENSE SCIENCE, TECHNOLOGY, INDUSTRY IMPROVE

OW231049 Beijing Domestic Service in Mandarin 2335 GMT 18 Sep 84

["Special program article" by the National Science, Technology and Industry Commission: "Our Great Wall of Iron"]

[Excerpts] In the 35 years since the founding of the PRC, our national science, technology, and industry have developed into a strong force, starting from scratch. All-encompassing and strategically rational research, experimentation, and production systems have been gradually established. Contingents of scientists, technicians, and workers with high political consciousness and fairly good scientific levels have been formed. They have equipped the Chinese PLA with weapons and equipment that we have developed and manufactured. Following the 3d Plenary Session of the 11th CPC Central Committee, development and manufacture of weapons and equipment entered a new stage. The standard of our strategic and conventional weapons has been further raised and troops' armaments further improved. The heroic PLA is still stronger under the new historical conditions.

Generally speaking, New China's achievement in defense science, technology, and industry is threefold: 1) Development and manufacture of conventional weapons to equip the PLA's ground, air force and naval units; 2) independent and self-reliant development and production of strategic weapons to increase our self-defense capacity; and 3) integration with civilian industries to actively serve the four modernizations.

After the 3d Plenary Session of the 11th CPC Central Committe, in accordance with the Central Military Commission's decision on the orientation and emphasis on weapons and equipment development, we stepped up efforts to develop and manufacture weapons and equipment for the ground forces in the following three categories: 1) Ground assault forces with main tanks and infantry armored cars as their backbone strength; 2) ground neutralization forces with long-range cannons, self-propelled guns and rockets as their main strength; and 3) antitank weapons forces with antitank guided missiles, antitank guns, antitank mines and rocket launchers as their main strength.

To meet the needs of the Air Force and Navy, we produced supersonic fighters, bombers, attack planes, transports, and helicopters as well as ground-to-air

and air-to-air guided missiles, completely equipping the Air Force with domestically available equipment. We also produced destroyers equipped with guided missiles, escorts, torpedo boats, high-speed gunboats, submarines, and guided missiles for coastal defense.

On the basis of successful development of carrier rockets, we made further efforts to develop space aviation technology for use in communications, radio broadcasting, TV, meteorology, and remote sensing. Since the successful launching of a man-made satellite in 1970, we have launched a total of 15 man-made satellites.

In conformity with the development of weapons and equipment, we have made tremendous achievements in electronic technology. We have successfully manufactured various electronic equipment for airplanes, carrier rockets, satellites, and navy vessels.

Beginning in 1979, our national defense science, technology and industry underwent readjustment and reform, turning the unitary structure for military equipment production into one producing both military and civilian products. On the basis of compatibility and similarity, our national science, technology, and industry produced equipment for coal, petroleum, communications, and transport departments and assisted the light, textile, and food-processing industrial enterprises in undergoing technical transformation. In addition they produced many kinds of durable consumer goods. In 1983, the output value of civilian products rose to 22 percent of their total output value from 10 percent in 1978.

As of 1983, national defense industry had signed nearly 500 contracts on technical transfer and economic or technical cooperation with over 10 civilian industries and over 20 provinces, municipalities, and autonomous regions.

CSO: 4008/22

SCIENTIFIC RESEARCH AT ADVANCED INSTITUTIONS

OW231808 Beijing Domestic Service in Mandarin 1200 GMT 21 Sep 84

[Text] Over the past 35 years our institutions of higher learning have not only trained a large number of scientists and technicians for the state but have also made many achievements in scientific research.

According to statistics, our institutions of higher learning have more than 1,400 scientific research institutes with 390,000 teachers and scientific researchers. Among them are professors and associate professors who account for approximately half the country's experts with high technical titles.

With the continuing growth of the contingent of scientists and technicians, institutions of higher learning have made rapid progress in scientific research. Some scientific fields have now become the main targets of our scientific research.

Our institutions of higher learning have made tremendous achievements in scientific research. Of the 122 natural science prizes given by the state in 1982, 56 were won by institutions of higher learning, accounting for 46 percent. Furthermore, institutions of high learning received four of six first-class prizes. A new method of arc welding control [han jie dian hu kong zhi fa] invented by Qinghai University represents a breakthrough in the traditional welding techniques used in the past century or so. The university received a first-class prize for the invention. This method has been popularized and used in the country and has also been transferred to some industrially developed European countries.

The scale of scientific research in our institutions of higher learning has also been considerably expanded in recent years. There are now more than 430 institutes of philosophy and social sciences. They publish over 250 academic journals. Seventy percent of the country's researchers work at institutions of higher learning. They are undertaking half the research tasks in social sciences set by the Sixth Five-Year Plan.

The Ministry of Education has made arrangements for 33 institutions of higher learning to tackle difficult problems in the natural sciences. These institutions undertook 146 state projects to tackle difficult scientific and technological problems in 1983. They also took up more than 5,000

research projects entrusted by production departments. They made 500 major scientific and technological achievements, published over 10,000 research papers, and appraised nearly 700 scientific and technological achievements in 1983. Of the 700 scientific and technological achievements in 1983, 116 are up to advanced world levels. Nearly 500 such achievements have been popularized and used in production.

CSO: 4008/22

SHAANXI: MEETING ON DEVELOPING NORTHWEST CHINA ENDS

HK011138 Xian Shaanxi Provincial Service in Mandarin 1130 GMT 28 Sep 84

[Text] The national meeting on scientific and technological cooperation in developing northwest China concluded yesterday, following 8 days of exchanging technology and conducting discussions. At the meeting, agreements on some 2,600 items were reached and the letters of intention for 500 of them were officially signed. It is estimated that the 500 items will increase the industrial and agricultural output value of five provinces and autonomous regions in northwest China by some 300 million yuan.

At the meeting, 44 universities and colleges and 58 scientific research units throughout the country provided examples of some 2,000 achievements, and enterprises in five provinces and autonomous regions in northwest China put forward some 2,000 difficult problems concerning production and called for bids to tackle them. After consultations with many departments, agreements on more than a half of them were reached. Some 90 percent of them were problems in township and town enterprises.

The representatives attending the meeting unanimously held that this meeting has promoted the joining of scientific and technological markets in all places throughout the country with the scientific and technological markets in northwest China and has resulted invaluable experiences for shifting the scientific and technological achievements along the coasts and in large cities to the interior of northwest China.

CSO: 4008/22

BRIEFS

NEW SCIENCE JOURNAL--KEJI JINBU YU DUICE [4430 2111 6651 2975 5280 1417 4595 SCIENTIFIC AND TECHNOLOGICAL PROGRESS AND COUNTERMEASURES], a journal jointly sponsored by the Hubei Provincial Science and Technology Commission and the Science Department of GUANGMING RIBAO, began publication on the even of the 35th national day. Fang Yi, member of the Politburo of the CPC Central Committee and State Councilor, wrote the title for the journal. The journal is created to seek ways to achieve scientific development and technological progress with Chinese characteristics; study strategies for scientific development and policies and measures for using science and technology to speed up economic development; disseminate experience in organizing and managing scientific and technological work; and publicize exemplary cases of reforming the science and technology management system. The journal features nearly 20 columns of information on scientific and technological progress, biographies of technical specialists, and other information. The first issue of the journal carries an article by Song Jian, minister in charge of the State Science and Technology Commission, and articles on modern technological revolution and the reform of state organs. [Text] [Beijing Domestic Service in Mandarin 1000 GMT 27 Sep 84]

INSCRIPTION FOR SCIENCE JOURNAL--Beijing, 9 Oct (XINHUA)--GUOJI XIN JISHU [NEW INTERNATIONAL TECHNOLOGY], a magazine introducing mainly new technological revolutions in the world and international scientific and technical information, was recently published simultaneously in Beijing and Hong Kong. State Councillor Fang Yi wrote an inscription for the inaugural issue, which reads: "Provide information to promote exchange." Minister of Electronics Industry Jiang Zemin wrote a preface for the inaugural issue, in which he hoped that the magazine will provide accurate, timely information to enable us to broaden our vision to the whole world. GUOJI XINJISHU, a bimonthly, is jointly published by China's Zhanwang Publishing House and Hong Kong. Kewan Company, Ltd. Editors of the magazine are economic or technological experts or writers of popular science. State Councillor Zhang Jingfu wrote the title of the magazine on its front page. [Text] [Beijing XINHUA Domestic Service in Chinese 0752 GMT 9 Oct 84 OW]

CSO: 4008/22

PROSPECT OF INSTRUMENT MATERIALS IN CHINA BY 2000

Chongqing YIQI CAILIAO [JOURNAL OF INSTRUMENT MATERIALS] in Chinese No 1, 1984 pp 1-6

[Article series by Kang Changhe [1660 2490 7729], Zhou Wenyun [6650 2429 6663], Guo Yanyi [6753 3348 0308] and Guan Dagao [1351 6671 7559]: "Prospects for Instrument Materials in China by the Year 2000"]

> [Text] (Editor's Note) Based on the spirit of the study "China by the Year 2000" launched by the Chinese Science Association and the discussion meeting on "Instruments in China by Year 2000" sponsored by the Chinese Instrument Society, a special topic discussion on the subject of "Instrument Materials in China by Year 2000" was arranged at the second annual meeting of the Instrument Materials Society held in Wuhan on 8-12 October. Some of the speeches and papers will be gradually published in this journal in order to welcome the vast numbers of readers to participate in the discussion of this subject matter. The contents may cover the entire technical area in instrument materials, a specific aspect, or a description of the prospects of a special topic. This journal will selectively print such articles to promote the development of the instruments industry in China.

I. Development of Semiconductor Instrument Materials by the Year 2000

[Article by Kang Changhe, associate director of Semiconductor Teaching Research Office in the Department of Electronics at Jilin University]

The semiconductor industry is rapidly developing. Semiconductors are the fundamental materials for the semiconductor industry. This paper is an introduction of the current technological standards of silicon and compound semiconductors, and an analysis and projection of the developing trends in semiconductor materials and devices by the year 2000.

A. Silicon Semiconductors

Single crystal silicon is the primary material for integrated circuits. It also plays a leading role in semiconductor materials. In the 21st century,

the role of silicon will not change. Japan is already capable of making the world's largest low carbon content 8 inch (approximately 200 mm)-diameter single crystal silicon wafers without any dislocation. Its oxygen content can be controlled at will. Currently, other countries are using 4-5 inch-diameter high quality single crystal wafers to fabricate integrated circuits and other silicon devices.

Using memory as an example, the integration of single wafer integrated circuits was doubling every year before the eighties. Large-scale integrated circuits such as the 64K dynamic RAM (single wafer integration level is approximately 150,000 transistors) are in batch production. The 256K memory has already been successfully developed (approximately 600,000 transistors in integration level). The rate of integration may decrease slightly in the future to two folds every 2 years. Based on this rate, a single wafer very-large-scale integrated circuit may reach an integration level of 10^8-10^9. By then we may have three dimensional memory devices with more than 10 layers in structure (single wafer integrated circuit over 10M). We may be able to use perfect defect-free crystals to fabricate ultrahigh-speed switching devices at ultrahigh frequencies such as 1000 GHz, or below 50 ps.

The quality requirements of semiconductor materials will become more stringent if these aforementioned devices are to be made practical. Not only will large diameter single crystal silicon have to be fabricated, but also there must be no dislocations or microdefects. The oxygen and carbon contents must be controlled or eliminated altogether. The logitudinal and transversal impurity distribution must be homogeneous. In order to obtain high quality single crystal silicon, it is also necessary to adopt new techniques such as molecular beam epitaxy.

In addition to single crystal silicon, polycrystalline silicon, silicon ribbon, and amorphous silicon are also actively under development. Amorphous silicon, due to its low cost, has been used to fabricate solar cells and has received a lot of attention. The cost of amorphous silicon solar cells can be reduced to 1 percent of that made of single crystal silicon. It is estimated that large area amorphous silicon solar cells may become practical by 1990. The efficiency will be improved to over 10 percent. Furthermore, the use of amorphous silicon as sensor elements has received some attention.

In summary, the fabrication of integrated circuits is the key in the semiconductor industry. Therefore, the preparation of large diameter, high quality single crystal silicon is also a key point.

B. Compound Semiconductors

There are many compound semiconductors. Certain properties of some compound semiconductors are better than those of silicon. Or, they have certain characteristics which cannot be found in silicon. There are also many applications. The following is an introduction to the status and prospects of compound semiconductors.

1. GaAs Integrated Circuits

In order to increase the speed of an integrated circuit, several new devices and materials, including Josephson devices, were proposed. However, from the viewpoint of materials, the research of GaAs integrated circuits is still favored. The eighties will be the time for GaAs integrated circuits. It is estimated that GaAs integrated circuits will have a 5-10 percent market share in Japan by 1990. An ultrahigh-speed computer made of GaAs integrated circuits and Josephson devices may appear by the year 2000. Its speed may reach 10^{11} computations per speed.

GaAs is a better quality material in compound semiconductors and has been studied for a long time. Single crystal GaAs, 75mm in diameter, can be fabricated by a liquid seal vertical pull method. However, a batch process capable of controlling diameter fluctuation to ±1mm has not yet been established. This presently is an urgent matter. The density of dislocation of a single crystal more than 2 inches in diameter sold on the Japanese market is in the $5x10^4/cm^2$ - $2x10^5/cm^2$ range. Moreover, the distribution of dislocation on the wafer appears in the shape of a W. Japan is developing 2 inch-diameter single crystal GaAs with a dislocation density of less than $8x10^3/cm^2$. It will have a U-shaped distribution which is more favorable in surface symmetry.

2. Materials for Optoelectric Devices

There are many types of semiconductor optoelectric devices, such as semiconductor lasers, emitters, solar cells and light sensors. Hence, there are also numerous semiconductor materials.

Materials for semiconductor lasers mainly include compound semiconductors such as InGaAsP (1.3-1.55μm), InGaAs (1.67μm) and GaAlAs (0.8μm) in infrared, and GaAlAs (0.7μm), InGaAsP (0.6-0.7μm) and AlGaInP (0.5-0.6μm) in visible.

Semiconductor lasers are primarily used in optical communications. An optical communications network was built in Wuhan this year. The range of optical communications has already reached several dozen kilometers. By 2000, it will be possible to realize long range optical communications such as from Japan to Hawaii without any relay stations. Japan has already developed a semiconductor laser with a lifetime of 100,000 hours. Based on a high temperature test, the lifetime of a semiconductor laser may reach 10^9 hours.

Research in semiconductor lasers is divided into two directions: short wavelength laser (0.78-0.8μm) and long wavelength laser (1.2-1.6μm). The characteristics of a conventional semiconductor laser will change with temperature because the electron distribution changes due to the fact that the density of states differ in different positions of the energy band. In order to improve this change of characteristics with temperature, the study of quantum well semiconductor lasers is being actively pursued. The fabrication of such lasers will require new technologies such as molecular

beam epitaxy or MOCVD. The establishment of this new technology is a key point.

Materials for semiconductor light emitters mainly include compound semiconductors such as GaP (red, green), GaAsP (red, orange), GaN (blue) and GaAlAs (red) in display, as well as InGaAsP (1.3μm) and GaAlAs (0.66μm) in optical communications. The intensity of red GaAlAs diode is the highest. The present level is above 1 cd (I_F = 20 mA). The response speed is 20 ns. Such a high response speed can already be applied in optical fiber communications.

Materials for solar cells can be divided into two major categories: one is silicon including single crystal, polycrystalline, ribbon and amorphous silicon solar cells as described earlier. The other is compound semiconductor solar cells such as GaAs, CdS and Se. The conversion efficiency of compound semiconductor solar cells is higher. The maximum efficiency of the heterojunction GaAs-GaAlAs solar cell has exceeded 20 percent. By the year 2000 new low cost semiconductors more than 20 percent efficient will emerge.

3. Materials for Microwave Devices

GaAs, InP and InGaAs are seriously considered as materials for microwave devices. Their electron mobility is relatively high. Microwave devices made of these materials have already reached the μm stage. The current research is directed toward the use of molecular beam epitaxy and MOCVD to prepare microwave devices with GaAs-GaAlAs super lattice structure. In this heterogeneous structure, only GaAlAs is selectively doped, while GaAs remain very pure. Electrons will migrate to the GaAs layer which has a high electron affinity to form a two-dimensional electron gas at the interface. Because of lack of impurity scattering, the migration rate is very high. Data obtained to date shows that the rate of migration is as high as 1,150,000 $cm^2/V.s$ at 5°K. This selective doping effect may exist in semiconducting materials such as InP-InGaAs and InAlAs-InGaAs.

4. Materials for Sensors

All countries in the world have begun to pay attention to sensors. Computer and other machines function by receiving external instructions, which sensors are primarily used to accept. The quality of sensors will directly affect the function of the entire machine. There are many sensor materials, including materials other than semiconductors. Furthermore, new materials continue to emerge. For example, amorphous semiconductors, semiconducting or conducting polymers, porous metal oxide ceramics and optical fiber materials are being actively investigated. A flavor sensor almost as sensitive as the human nose may be developed by the year 2000. It may be possible to build computer controlled robots with temperature, load, gas and humidity sensors.

C. Other Semiconductors

In addition to silicon and compound semiconductors, the research on special semiconducting materials such as organic semiconductors and rare earth semiconductors must not be neglected. They may possess new functional characteristics not yet known to us.

Due to my limited understanding, only superficial viewpoints are introduced. There may be many unavoidable mistakes. I welcome any corrections.

II. Status of Magnetic Materials and Devices and Prospects for the Year 2000

[Article by Zhou Wenyun, senior engineer of Southwest Institute of Applied Magnetics, Ministry of Electronic Industry]

Magnetic material is an important branch of instrument materials. It has been developed rapidly in recent years. In addition to improved magnetic characteristics, it is moving in the direction of single crystals, thin films and amorphous materials. In production, mechanization, automation and continuous process are replacing manual operation. Major materials and devices are described in the following:

A. Permanent Materials and Devices

The development of permanent magnets now receives more attention because of the energy shortage. Ferrite permanent magnets are produced in large amounts. The current focus is to improve the efficiency of wet pressure forming. The automatic press and die for wet pressure and dry pressure magnetic forming designed by the Dorst Corporation of West Germany rely on an absorption filtering technique to remove water. The forming efficiency is extremely high and the dimensions of products can be rigorously controlled. China has already imported this machine to significantly improve product quality. Mechanical arms are used in Japan so that one person can operate five presses simultaneously. Each press can produce 300,000 pieces per month. Semifinished products may be sintered after 24 hours of natural drying. The production cycle from raw material to product is only 5 days. In terms of technological reform, topological reaction and hot press forming were employed. Anisotropic ferrites whose orientation is not determined by the magnetic field were prepared by a rolling technique based on the anisotropy in shape. Because of its higher saturated magnetization, Curie point, anisotropic field and density, the W-shape may have better magnetic properties. The present magnetic energy product is 4.3 MG·Oe. If sintering can be done in air by other means such as ion exchange, we will be able to produce better magnets at lower costs. In addition, if ferrites can be mass produced, the cost can be drastically reduced.

Rare earth permanent magnets are the best. China has rich rare earth resources. Therefore, the prospect of this type of permanent magnet in China is bright. The magnetic energy product is over 30 MG·Oe in China. It has already reached 37.3 MG·Oe in sintered magnet $Sm(Co_{0.61}Mn_{0.12}Zr_{0.01}Hf_{0.01}Fe_{0.25})_{8.2}$ prepared by Hexiyihe [phonetic 3109 6007 0001 0735] et al. in Japan. According to a recent report, Zhuyou [phonetic 0145 0645] Special

Metals Company in Japan has already developed a new rare earth permanent magnet whose primary content is neodymium-iron. Its structure is different from RCo_5 or R_2Co_{17}. The current characteristics are: B_r = 12.3kG, BH_c = 11.3kOe, residual magnetic temperature coefficient at ambient temperature = -0.126%/°C, Curie point = 345°C and magnetic energy product = 35 MG·Oe. Japan expects to produce 2 tons this year. The mechanical properties of this magnet, such as tensile and yield strength, are more than twice as good as sintered Sm-Co. However, the temperature coefficient is higher, suitable in quantity for civilian use. It is projected that the world will produce 400 tons of rare earth this year. By 2000, the annual production in China is expected to reach 50-100 tons. Its primary applications are for electric machines, accessory tubes in vacuum systems, magnetic fields for transmission, suspension and NMR scanning imaging device in the early diagnosis of cancer and pathological changes. Technically, we must develop low oxygen and even oxygen-free techniques. The magnetic energy product of rare earth magnets is estimated to be 72 MG·Oe by the 1990's.

B. Floppy Ferrite Magnet

Floppy ferrite magnet is still primarily centered around manganese-zinc ferrite. Good results have been obtained in high magnetic permeability, high saturated magnetization, low loss and high stability, crystal orientation and single crystallization in China. A rotary kiln is already in production. Advanced equipment such as nitrogen tunnel kilns, atomization drying machines and sand grinders has been imported to improve product quality.

Recently Japan has produced a large single crystal, ϕ90x800mm in size. Furthermore, it is homogeneous over a large range lengthwise. The manufacturing technique is a combination of the Boltzmann method and the zone smelting process. The size of single crystals made in China is smaller. However, the crystal characteristics and effectiveness are good. The crystal characteristics are: μ_0=2000 (at 1kHz) and 800$\sim$1300 (at 5μHz), B_S=4050-5300G, B_r= 378$\sim$750G, H_C=0.018$\sim$0.0530e, T_C=110$\sim$130°C, H_V= 600-700 and ρ=5.1g/cm^3. Tianjin University has fabricated a furnace capable of producing 2 kg of single crystals. Its noise problem is still to be solved.

The Chinese practical standard for oriented spinel ferrite is: orientation $\geq$95%, porosity <0.1%, crystal size 100μm, $\mu_0 \geq$10,000 (1KHz) and $\geq$800 (5MHz). Future effort will be focused on noise reduction, improvement of mechanical characteristics, employment of the hot static isobaric technology and fabrication of biaxially oriented ferrite.

C. Amorphous Magnetic Materials

It was a major breakthrough to switch from crystalline to amorphous materials. For instance, the magnetic flux density of amorphous $Fe_{80}B_{20}$ can reach 17,000 G. The ion loss is low and electrical resistivity is high. In 5 years it may be used as the core of power transformers to significantly conserve energy. Amorphous materials such as the Fe-Ni-Si-B series

and Fe-Co-Si-B series are suited for aduio and video heads because of high magnetic permitivity (3,000,000 maximum), large magnetic flux density, low coercivity (0.001 Oe), high resistivity, good corrosion resistance and high hardness. It is estimated that amorphous video heads will be produced in China within 5 years. In addition, the high iron content Fe-B series amorphous material has a high magnetostriction coefficient; λs usually higher than $4x10^{-6}$. Moreover, the magnetic permitivity is high. These properties can be employed for various measuring devices. China has already developed amorphous delay lines. In addition to making floppy magnets, amorphous materials may be used in microwave and permanent magnets. It is projected that amorphous materials will be employed in all aspects of magnetism.

D. Magnetic Recording Techniques

The development of magnetic recording techniques is very rapid. The major indicator is increasing density of magnetic records. In the area of audio and video recording, the original recording wavelength was several hundred μm. It is developed to 1 μm. In the near future, it will become 0.3∿0.5 μm. In the digital recording domain, the line density was improved by 4 folds in 15 years from 1965 to 1980. The channel density was improved by 10 times and surface density by 40 times. Recently a 10,000∿12,000 byte/in device was developed. Its channel density is 800-1,000 channels/in. By 1985, it is predicted that the line and channel densities will reach 25,000 byte/in and 2,000 channel/in, respectively. By 1990, they can be 50,000 byte/in and 4,000 channel/in, respectively. In the newly developed vertical recording method, the density may reach 100,000 byte/in. Its record density increases exponentially.

In order to adapt to such developments, magnetic recording media are also improving. B_r and H_c are further increased. B_r is increased from 3,000 G to 15,000 G, and H_c from 300 Oe to 3,000 Oe. The magnetic coating is getting thinner. For instance, it was 35μ thick on magnetic discs in 1960 and was reduced to 0.6μ in 1980. Furthermore, better magnetic recording media were developed. γ-Fe_2O_3 was further developed into Co containing γ-Fe_2O_3, CrO_2, and metallic microparticles. The recording medium is developing toward a continuous (thin film) format from coatings. Metal thin film discs and tapes were introduced. For example, the Panasonic metal thin film tape was commercialized in 1979, producing 100,000 boxes per month. In order to keep up with metal thin film tapes, metallic head materials were developed. New progress was made in Fe-Si-Al alloys and amorphous materials. In order to improve the characteristics of coatings mentioned above, the binder system in the paste was thoroughly studied to significantly improve its stability, wear resistance and adhesion. Furthermore, water soluble binders were investigated.

E. Magnetic Bubble Device

A magnetic bubble device is a solid state device which can be used to store and manipulate information based on reversal of magnetism in a magnetic thin film. It is reliable, has no volatility, and can tolerate hostile

environments. One-megabyte devices have already been prepared. By 1990, the capacity may reach 16 megabytes. China should be able to fabricate 1/4- to 1-megabyte devices by 1990. By the end of this century, 16-megabyte devices should be manufactured. They are expected to have special applications in telephone exchanges, digitally controlled lathes, automated measuring instruments, microcomputers and terminals for large computers. They also should have a market share in military and aerospace applications. Magnetic bubble devices are expected to coexist with and complement magnetic discs and tapes.

F. Magnetic Fluid

Magnetic fluid is a new instrument material. It involves a magnetic colloidal solution which is made by dispersing extremely fine magnetic particles in a liquid carrier through the use of a surfactant. The first generation magnetic fluid mostly employed Fe_3O_4 fine particles. Because its saturated magnetization is low, the second generation magnetic fluid was developed. It involves the dispersion of fine Co and Fe particles in organic solvents or mercury to attain a saturated magnetization of 1500 G. The prospect of magnetic fluid in instrumentation, such as display, damping seal and sensors, is very bright. Lately magnetic fluid is used in processing equipment for wire and pipe drawing. If magnetic fluid and liquid crystal technology can be combined, a series of interesting strongly magnetic liquid crystal materials can be developed.

III. Combining Resources and Needs To Develop Electronic Ceramics

[Article by Guo Yanyi, associate researcher, Shanghai Institute of Silicates, Chinese Academy of Science]

As new technologies are continuously developed and people's needs are becoming more demanding, it is more apparent that electronic ceramic is an important branch in precision ceramics (modern ceramics). It has already penetrated various technologies which promoted their rapid development to obtain surprising results. This area has already received attention in technologically advanced countries. It was included in a specific development program together with engineering ceramics. Although China has some background in electronic ceramic materials and technology, it is still lagging behind other countries. Exploratory research work, in particular, is lacking. The gap in production and application is even greater. Therefore, it is necessary to combine our resources and requirements to launch fundamental and applied research on electronic ceramic materials and their applications in order to create new materials according to trends of development in the world.

Electronic ceramic material is an inorganic nonmetallic material. From its electrical characteristics, it may be divided into ceramic insulators such as ceramic substrates and resistors, ceramic dielectrics such as ceramic capacitors, ceramic semiconductors such as ceramic thermisters, sensors and rheostats, and ceramic conductors such as ionically conductive β-Al_2O_3 in Na-S batteries, ZrO_2 oxygen analyzers and electronically

conductive ceramic superconductors. From optical and photoelectric properties, it can be divided into transparent ceramics such as the transparent sodium aluminum oxide tube and infrared transparent fluoride ceramics, reflective ceramics such as TiN, polarizing ceramics such as the PLZT light switch and thermoelectric ceramics such as ceramic infrared detectors. From the conversion among electric, mechanical and acoustic characteristics, there are many piezoelectric ceramic materials with a variety of applications, including lead zirconate titanate based solid solutions, modified lead titanate, lithium sodium niobate, sodium barium niobate and bismuth containing layer structure ceramics. They are primarily used in ultrasound, hydroacoustics, high voltage generation and various detectors.

Based on developments abroad, high capacity dielectric ceramics are being miniaturized. The major development is a miniaturized low-sintering-temperature multiple level ceramic capacitor with a capacitance of 400μF. Microwave ceramic dielectrics are also rapidly developed. It mainly involves the fabrication of ceramic dielectrics suitable for microwave communications and satellite communications. The research on semiconducting ceramics and ferroelectric-piezoelectric ceramic materials for developing sensing technology and devices has picked up strength in order to improve the quality and function of the sensor to meeting the requirements of information processing and to broaden the range of applications. In order to satisfy the characteristic requirements of various sensing devices, many oxide and composite oxide ceramic materials have been investigated abroad. The stable cubic fluorite structure such as ZrO_2-MgO, ZrO_2-CaO, ZrO_2-Y_2O_3 and ZrO_2-La_2O_3 and spinel structured solid solutions of Al_2O_3 and MgO such as $MgAl_2O_4$, $Mg(AlCrFe)_2O_4$ and $CoAl_2O_4$ were used in high temperature sensing, primarily in automobile exhaust detection, temperature control to prevent pollution and temperature sensing for home appliance and industrial equipment. Ceramic materials including $MgCr_2O_4$-TiO_2, $MgAl_2O_4$-xFe_2O_4, $ZnCr_2O_4$-$LiZnVO_4$, $Ni_{1-x}\cdot Fe_{2+x}O_4$, Fe_2O_3, TiO_2-V_2O_5, TiO_2-SnO_2, and $Ca_{10}(PO_4)_6(OH)_2$ are used in humidity sensing. The reliability, consistency and interchangeability of humidity sensors must meet high standards. Not only are they required to have good aging characteristics and low cost, but they also should maintain their accuracy in a smoky and dusty environment. Ceramic materials for gas sensing are mostly metal oxides such as sintered SnO_2^{+pd}, γ-Fe_2O_3, ZnO-$Ga_2O_3^{+pt}$, ZnO-$Ca_2O_3^{+pd}$, $MgCr_2O_4$-TiO_2, $LaNiO_3$, (LaSr)CoO_3 and (BaLa)TiO_3. Different materials and catalysts will have different sensitivity and selectivity to gases. The current humidity and gas sensing ceramic materials cannot satisfy the need of the growing information processing devices. The performance characteristics of materials and devices are yet to be further investigated and improved. In position and speed sensing, microdisplacement sensors, vibration detectors, acceleration sensors, liquid surface detectors, and blood flowmeters made of piezoelectric ceramic materials are employed. Ferroelectric ceramics are used to fabricate infrared detectors in light sensing, based on the thermoelectric effect. Lead titanate and lead zirconate titanate are already commercially available.

Starting from the status of research, production and utilization of electronic ceramics in China, together with the resources, we can consider

launching studies of composite oxide systems and solid solution ceramics based on the abundant niobium-tantalum, titanium-zirconium, and rare earth oxides. By taking spinel, fluorite, perovskite, tungsten bronze, and layered structures into consideration, the electrical properties under various sintering conditions will be studied. Some new materials will be exploited to improve their stability, reliability and performance. In the area of devices, the focus should be placed on the development of sensing and measuring techniques in order to promote the study of new ferroelectric, piezoelectric materials and semiconducting ceramics to meet the requirements in detection and information processing. We should also develop new techniques such as crystal orientation, thin film preparation, ultrafine powder preparation, micropore control and super high pressure and temperature static isobaric processes based on need by combining with the characteristics of various materials. In addition, development of techniques to combine various materials and prepare composite materials as well as the research on microcomposite materials will be launched to facilitate the development of multi-functional composite devices. In the area of materials, studies on purification and synthesis, correlation between crystal structure and performance, effect of grain and grain boundary, structure and characteristics of pores, and effect of surface will be conducted to fundamentally grasp the laws governing variations of ceramic materials.

In addition to focusing piezoelectric ceramics on medical diagnosis and microdisplacement sensing, they are also in surface wave filters for TV sets abroad. Active work is also in progress to fabricate piezoelectric ultrasonic motors. We should also pay more attention and begin to investigate.

IV. Marmem by the Year 2000

[Article by Guan Dagao, senior engineer, Shanghai Institute of Nonferrous Metals]

A. Introduction of Current Status

The research and exploitation of alloys with a shape memory effect have been around for over 20 years. The prospect appears bright. Because the structure of these alloys (several dozen are known) is basically in sequence, therefore, their production is very difficult. Only Nitinol and β copper-zinc-lead alloy can be prepared. The former is being produced in small amounts in the United States, England, Japan, the USSR, Switzerland and Belgium. As for the latter, England and Japan have obtained major breakthroughs and it is actually used in practice.

In terms of utilization, there were over 100 patent applications as of the end of 1981. Most of them involved Nitinol because of its good corrosion resistance. As for applications, the shape reversibility is appropriate for space systems, vacuum components, nuclear reactors and underwater devices. For instance, the antenna of a space vehicle can be opened automatically, and fractured bones can be secured by such plates. The shape reversibility may also be used on devices for converting thermal

energy into mechanical energy, constant temperature regulators, artificial hearts, and toys. In addition, it is also quasi-elastic, capable of fabricating quasi-elastic glass frames and orthodontal braces.

Since 1976, a great deal of research has been done in China by Shanghai Institute of Steel, Zhongnan Institute of Mining and Metallurgy, Harbin Polytechnical Institute, Harbin University of Science and Technology, Tianjin Institute of Materials, Shenyang Nonferrous Metal Processing Plant, Shanghai Jiaotong University, Shanghai Alloy Plant and Kunming Institute of Precious Metals. Shanghai Institute of Steel is producing Nitinol in small batches. As for the copper alloy, it is still in an experimental stage which is approximately 15 years behind the rest of the world.

Comparing Nitinol with β CuZnPb, the former has a supply of raw materials in storage, and is technologically more difficult and more expensive. The worldwide price of the former is more than 10 times higher than that of the latter. The raw materials for the latter are abundant. It has good electric conductivity, is easy to prepare, and costs less. However, its corrosion resistance is poor. Coarse grains can easily appear in production to cause intergranular embrittlement. The breakthrough of this technology may be easier to obtain with some effort. The Delta Metallurgical Company in England and various universities, research institutes and companies are extremely serious about it. Obviously, it is easy to mass produce the CuZnPb alloy and its price will be acceptable to customers. Especially in the trade of instruments, its electrical conductivity and memory can be fully utilized.

B. Significance of Topic Selection

Because the memory temperature of marmem is usually selected at between -50~+150°C, energy sources such as solar energy, industrial waste heat, ocean and lake thermal energy, and geothermal energy can be fully utilized. This is new territory for power plants. High power memory engines are under design abroad for small scale power generation. When fully expanded, the energy shortage in China can be somewhat relaxed.

Despite some self-initiated work done by research institutes in China, it was not included as a key project in the national plan. Because the effort was not concentrated, problems could not be easily solved and the priority was not clear. It is my suggestion to organize and plan our effort in a unified manner to attack the copper based material. By concentrating primarily on the copper based material and taking nickel titanium as a secondary target, we should study other suitable alloy compositions. By referring to experience abroad and by our own hard work, we will be able to obtain major accomplishments in shape memory alloys. By the year 2000, we should be able to catch up with and exceed the present world level.

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NEW PROCESS FOR GROWING α-LITHIUM IODATE CRYSTALS

Beijing FAMING YU ZHUANLI [INVENTIONS AND PATENTS] in Chinese No 4, 1983 pp 26-27

[Article by Gu Shouquan [6328 1108 3132], Chen Wanchun [7115 5502 2504], et al.]

[Excerpts] Frequency-multiplying crystals are among the key materials needed in laser technology. In 1968, Kurtz et al. at Bell Laboratories in the U.S. first discovered the frequency multiplication effect in α-lithium iodate ($LiIO_3$) powder. During the same year, Haussuhi in West Germany grew small single crystals of $\alpha LiIO_3$ by slow evaporation at 45°C and measured their piezoelectric activity. Because of their advantages, α-$LiIO_3$ crystal electrodes were subsequently employed for laser frequency multiplication, in parametric oscillators, and in other areas of technology. Much interest was generated by the possibility of using the crystals to develop high-frequency high-bandwidth ultrasonic converters. Japan, England, France, the United States, and other countries began research on methods for growing α-$LiIO_3$ crystals. However, owing to the lack of a scientific growth process there was no success in growing large crystals; moreover, the yields were low and the quality poor.

No further reports on this research have appeared since 1973. Then in 1977, Ardenko et al. in the USSR employed a cyclic convection process to grow $\alpha LiIO_3$ crystals 60 mm in diameter and 80 mm long. However, this method required that α $LiIO_3$ first be prepared to serve as a solid growth material. This requirement greatly increased the complexity of the equipment, the crystals were expensive to produce, and there were other disadvantages, so that the method was not suited for general application.

Our three-step method for growing large single α-$LiIO_3$ crystals was the culmination of a study of the growth kinetics carried out in our laboratory. This study required precise measurements and a series of investigations of the metastable region of the binary phase diagram, solubility effects, etc. We searched for optimum conditions for growing high-quality α-$LiIO_3$ crystals and established a set of efficient growth processes for producing crystals superior in size and quality to those obtainable elsewhere.

In these new processes, large α-$LiIO_3$ crystals of high quality are grown on Z-cut crystal wafer seeds which are rotated in a supersaturated aqueous solution. Water is supplied to the system at constant temperature and evaporated. A somewhat simplified but more detailed description follows.

1. PREPARATION OF THE INITIAL HIGHLY PURE $LiIO_3$ MATERIAL

We prepared a stoichiometric solution of $LiIO_3$ and treated it first with excess Li_2CO_3 and then with LiOH of various concentrations. The mixture was heated and allowed to react at constant temperature, after which the solution was filtered through a combination of rod filters of various sizes.

This removed all of the insoluble impurities and alkaline-earth metals, heavy metals, and amphoteric ions. We then employed the recrystallization method to eliminate alkali metal ions and other types of impurities. This method yielded initial $LiIO_3$ material of purity better than 99.99%.

2. RAISING THE YIELD OF α-$LiIO_3$

The crucial factor determining the success or failure of the $LiIO_3$ growth experiments and the yield is the ability to control the formation of cubic α-$LiIO_3$ crystals and keep them from mixing with the $LiIO_3$ crystals. In order to minimize α-$LiIO_3$ formation, we carried out detailed measurements of the α and β modificiations to determine the metastable region of the solution phase diagram (i.e., their solubilities and supersolubilities). We exploited the conditions required for formation of the α and β phases in aqueous solution and the relative α, β solubilities to develop a reliable method which gives excellent results when crystals are grown at temperature $T \geq 60^0C$ and avoids formation of the β-phase. Our findings contradict the only published report on the French research in this area, as well as some other empirical conclusions reached outside China. On the other hand, they provide a satisfactory explanation for many kinds of phenomena observed in laboratory processes, and the results have been used successfully in designing a series of α-$LiIO_3$ growth experiments. Moreover, our findings have stood up under long-term testing and verification and the process has passed through the experimental stage to more general application.

3. IMPROVING THE QUALITY OF THE α $LiIO_3$ CRYSTALS

In addition to improving crystal quality by using prepurified raw materials, cleaving crystal seeds, and other methods, it is also important to experimentally determine how the temperature and acidity of the growth solution, the crystal growth rate, and the rate of rotation influence the distribution and formation of inclusions inside the crystal (the density of inclusions is the main index of the quality of the crystals). We determined the main factors governing the concentration of inclusions, defined a suitable paramter to account for these effects, and then determined its optimum value. In addition, experiments were the first to employ anomalous x-ray diffraction to determine the absolute conformation of the α-$LiIO_3$.

The x-ray measurements revealed that the crystal grows rapidly toward the anode end of the crystal and provided further insight into the growth mechanism of α-$LiIO_3$. On the basis of the x-ray results we decided to grow the crystal from top to bottom in order to reduce thenumber of inclusions and prevent twinning. We also found that when the crystal was polished with a waterstone the positive end was smooth and bright, while the negative end was dull and rough. This provides a convenient way of identifying the positive and negative ends of the crystal.

We thus determined the optimum value of a composite paramter (obtained by combing the temperature, acidity and concentration of the solution, the cleavage direction of the seed crystals, the direction of crystal growth, the rotation speed, the growth rate, etc.) in order to devise our high-yield growth process. The dimensions and optical properties of α-$LiIO_3$ crystals grown abroad. These tables show that our crystals are far superior in terms of size; they are also more transparent to visible light and have a higher degree of optical uniformity. Their higher conversion efficiency for both single and multimode laser light, lower density of light-scattering particles (inclusions), and other criteria also make our crystals superior to all of the others.

The large high-quality crystals grown by the new process have already been used in China to develop an efficient laser-light converter, paramteric oscillators, and other components. These applications have stimulated new technical developments in related areas of research, industry, medicine and national defense. In addition, α-$LiIO_3$ crystals grown by our process have been used in research and development to design an ultrasonic converter and they are being used abroad successfully for the first time. For example, the Steel Research Academy has prototypes of a water-immersible flaw-detecting probe whose sensitivity is 20 times higher than that of $PbZrO_3$-$PbTiO_3$ ceramics. Six hundred twenty-five $20MH_z$ focusing ultrasonic converter probes and 10 MH_z ultrasonic converter probes equipped with delay units have been built. They are being used successfully in nondestructive measurements of the thickness of heterogeneous thin-walled components employed in precision manufacturing. The many crystal specimens which have been supplied for use in basic research in solid-state physics have played a fundamental role in several successful investigations of new phenomena. The economic potential of our high-yield inexpensive process is evident. Apart from the more than forty accounts in China that have received large numbers of crystals, numerous shipments have been made to the United States, Switzerland, the Netherlands, and Italy, and the crystals have been on display in four foreign exhibitions. Crystal samples have also been sent to Korea, Rumania, Yugoslavia, and Egypt, and they have been well received everywhere. The new process is now being used at the Chengdu Semiconductor Plant to grow $LiIO_3$ crystals in production quantities. The growth process is reproducible and yields crystals that meet all standards.

12617
CSO: 4008/106

GRADUATE STUDIES ON ENVIRONMENTAL SCIENCE SURVEYED

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 3, 30 Jun 84 pp 55-57

[Article: "Strengthen Coordination and Speed up the Training of Graduate Students of Environmental Science" -- written by Jiang Xiangli [1203 6272 7642] and edited by Prof Liu Peitong [0491 1014 2717] of the Research Institute of Environmental Science of Beijing Normal University]

[Text] Environmental science is a new comprehensive discipline involving many disciplines within natural sciences, technical sciences and social sciences. Environmental protection has been included in China's basic national policies. Therefore, it is an important and urgent task to speed up the training of competent people in the field of environmental science and technology. In order to bring about the development of environmental science and environmental protection undertakings, in 1978 our research institute (then the research office of environmental science under the department of geography) recruited 10 graduate students and formed a research class of environmental science along with 10 teachers who were selected and sent by various normal universities to take refresher courses. These graduate students, who graduated a long time ago and were assigned work at environmental scientific research, teaching and management departments, have all received favorable marks from their units. Reviewing the work of training graduate students, this article will discuss our understanding of such issues as recruiting students, designing curriculums, compiling teaching materials, selecting thesis titles, experience and suggestions.

I. Recruiting Students

Practice proves that doing a good job in recruiting students is an important link in training graduate students. When recruiting students for the departments of comprehensive and horizontal applied sciences such as environmental science we must persist in crossed disciplines. We cannot recruit students only in the field of this discipline as we would for most existing vertical disciplines. In the course of recruiting students, we considered a variety of specialized fields. As a result, the 10 graduate students came from different fields (two from natural geography, two from water conservation, two from chemistry, one from chemical engineering, one from mathematics,

one from automation and one from agricultural soil and chemistry). They all had nearly 10 years of work experience before they were admitted.

This recruiting method was first used in the early 1960's by Comrade Yu Guangyuan [0060 0342 6678] and others in recruiting graduate students of natural dialectics. The results were very good. However, most people could not understand this method at the time. Differing views existed both inside and outside the university. The Department of Graduate Students under the Ministry of Education and party and government leaders of the university supported us in our exploration. We drew up teaching plans based on the actual concerns of every student. We demanded that teaching plans not only include unified basic requirements but also "teach students in accordance with their aptitude". This is to give maximum consideration to every student's original speciality and work basis, and allow them to develop in certain fields. Regarding the aims of training, we demanded that students should have a solid theoretical basis and broad multidisciplinary basic knowledge, master basic techniques of various modern scientific researches, give full play to their strong points while avoiding their weaknesses and start out at a higher level to make new breakthroughs in their field of research.

II. Designing Curricula and Compiling Teaching Materials

Under the leadership of the Ministry of Education, a coordination group for training graduate students of environmental science at universities and colleges affiliated to the Ministry of Education was established in early 1978. A symposium of this coordination group was held in the summer of the same year. Attending the symposium were representatives of Qinghua, Beijing, Nanjing, Fudan and Tongji universities, Huadong Chemical Engineering Institute and the Beijing Normal University and other schools affiliated to the Ministry of Education. Also attending were representatives of the Beijing Medical School, the Beijing Industrial University, the Beijing Municipal Scientific Research Institute of Environmental Protection and the Beijing Municipal Environmental Monitoring Station. They exchanged views on the question of how to do a good job in training graduate students and decided to divide up the work among various universities, colleges and units in compiling the two textbooks "Principles of Environmental Science" and "The Outline of Environmental Monitoring" to be used in specialized courses for graduate students of various disciplines within environmental science. They also decided to sponsor lectures on specialized subjects and invite experts who have achieved research results in certain fields to preside over such lectures in order to help graduate students gain a certain depth and breadth of knowledge in various disciplines of environmental science.

In accordance with the guidelines of this symposium and our actual conditions, we drew up a concrete teaching plan for every graduate student. Political theory and foreign language courses were arranged by the university in a unified manner. Basic courses and specialized basic courses were designed in accordance with different concerns of every student. In addition, we arranged four specialized requirement courses, "Introduction to Environmental

Geology," "Principles of Environmental Science," "The Outline of Environmental Monitoring" and "Environmental Mathematics", for the research class.

We chose the book "An Introduction to Environmental Geology" by (?Stelas) of the United States (the Chinese edition of this book has been published by Science Publishing House) as the basic teaching material. This course requires that students systematically master the basic concepts and theories of various elements in the formation of the geographic environment; the formation, structure and dynamic variations, and the influence of human activities on the geographic environment.

Teaching materials for the course "Principles of Environmental Science" which later changed to "An Outline of Environmental Science" have been published by the Shuili Publishing House. This course requires that students systematically master the basic theories of environmental science, pollution sources in essential pollution factors such as air, water, soil, organisms and noise, damage and impact of pollution, pollutant migration and transformation patterns and pollution prevention and control measures.

Because proper teaching materials for the course "An Outline of Environmental Monitoring" were not available in China at the time, 11 concerned universities and colleges made cooperative efforts to compile such teaching materials and shared the responsibility of giving lectures.

The major subject of the course "Environmental Mathematics" was fuzzy collection theory and its application to environmental science. Fuzzy mathematics is a quantitative science that deals with the ambiguity of the subjective and objective world. In discerning, judging, regulating and controlling things, it uses a multiple-value logic instead of the "right" and "wrong" two-value logic. According to this logic, people adopt the principle of selecting the best by sifting out objects with a higher degree of affiliation and discarding those with a lower degree of affiliation, thus making it possible to quantify laws that could not be easily quantified in the past. The study object of environmental science is the relationship between man and the environment. Such a relationship is very complicated and highly comprehensive. Moreover, the environment itself is a pluralistic and heterogeneous dynamic variation system. Therefore, it is necessary to adopt the mode of thinking provided by this multiple-value logic to conduct the quantitative discern, judgment, regulation and control of many environmental science problems such as environmental quality assessment, environmental impact assessment, environmental forecast and planning and pollutant migration and transformation patterns.

In addition to the teacher who gave the lectures, two teachers were assigned to each of the above four specialized requirement courses to help organize teaching activities, answer questions and carry out experiments and other teaching work.

In accordance with the principles "make up what one lacks" and "study what one needs," some graduate students and teachers taking refresher courses in

the research class took basic courses and specialized basic courses in mathematics, physics and chemistry as their electives; others took basic courses and specialized basic courses in biology, geology and medical science. Some chose their electives among the undergraduate or graduate courses of this university; other took their elective courses in other universities. In short, in the first 2 years all graduate students and teachers taking refresher courses completed all courses in accordance with concerned regulations of the Ministry of Education.

III. Thesis Title Selection and Guidance

Teachers taking refresher courses graduated after 2 years of study. They were not required to write theses. The 10 graduates selected their thesis titles under the guidance of a graduate student guiding group consisting of professors and associate professors. The guidance was given through a combination of group training and individual instruction.

The key to writing a good thesis is the proper selection of a topic. When we selected thesis titles, we adhered to four principles:

1. It is necessary to proceed from the actual needs of China's environmental protection work, combine theory with reality and try to solve actual problems and bring forth new ideas in theory or methods.

2. It is necessary to bring every graduate student's strong points into full play in accordance with he basic knowledge of their original speciality and their work experience.

3. It is necessary to be familiar with the newest developments in the selection of thesis titles at home and abroad and guide students step by step into the "forward position" in various fields of environmental science so as to give their theses a "start from a higher level."

4. It is necessary for tutors to have a clear idea of the situation in the selection of thesis titles. They should consider the academic level of the graduation theses of graduate students and their time limit, do a good job in discussing and approving the proposition of thesis titles and help students carefully draw up a comprehensive plan. Every link in the thesis such as data collection and compilation, field survey, indoor experiment and computation, thesis composition and chart and graph drawing must be completed on time while the quality and quantity of work is ensured. Since we planned carefully ahead of time, all 10 graduate students passed the oral examination on their theses within the time limit set by the university. They were given a master's degree and a job assignment.

Regarding the guidance for theses, we focused on scientific research methods and the development of scientific research techniques. In the course of research, we pointed out the direction for students. But, in concrete research work, we let them take their own roads. Instead of running the whole show,

teachers encouraged students to use their creative initiative and have the courage to open up new fields. Some of the research results in the graduation theses of the 10 graduate students have been published in academic publications such as HUANJING KEXUE XUEBAO [JOURNAL OF ENVIRONMENTAL SCIENCE].

IV. Experience and suggestions

Based on the past few years of practice in work, our experience and suggestions for the improvement of future work are as follows:

A. In addition to recruiting students under the tutor system, we think that institutions of higher education where conditions permit may form graduate student guiding groups involving different departments and fields of study and use the method of combining group training and individual instruction. This can help not only recruit more graduate students but also bring collective wisdom and strength into full play and improve the quality of graduate students. This method is particularly advantageous to the development of disciplines when applied to multidisciplinary, comprehensive horizontal sciences. Since it can arouse the enthusiasm of all teachers and make full use of existing teaching equipment, it is also one way to do more things with less money and increase the economic and social results of educational investment.

B. In addition to training graduate students through the cooperative efforts by different departments and fields of study within the same school, we should also encourage different schools to cooperate with each other in recruiting and training graduate students (such as cooperation between engineering colleges and science colleges, between science colleges and agricultural and forestry colleges and between natural sciences and social sciences). Educational, scientific research and designing departments may cooperate with each other in recruiting and training graduate students. By doing so they can help each other bring into full play their strong points and avoid their weaknesses, fully utilize their own advantages and achieve greater results.

C. We should correctly handle the relationship between depth and breadth and between knowledge acquisition and intellectual development. To handle this relationship correctly, teachers should keep in touch with new scientific trends and go beyond the limits of their original disciplines and research. They should not stubbornly hold on to the field of their original research. Tutors should guide students in laying a solid foundation in basic theories and skills and help them develop their comprehensive thinking ability. For example, when we opened the four specialized requirement courses and lectures on specialized subjects, some individual graduate students thought that they were useless. We repeatedly explained to them about the comprehensive characteristic of environmental science and stressed the importance of solid and broad basic training and the development of comprehensive thinking ability. We believe that only those outstanding people who have a solid and broad foundation in scientific theories can keep in touch with the changes in scientific trends. However, because graduate students are different from college students, in addition to a solid and broad theoretical basis, they

need to have a certain depth of knowledge and make certain breakthroughs in their own field of study. Our demands on the depth of knowledge are: 1) We should integrate theory with reality, select scientific research subjects among issues which need to be solved in the practice of China's environmental protection work and gear scientific and technological work to economic construction to make it serve the latter. We should not look for scientific research subjects in documents, repeat predecessors' work and verify their conclusions at a low level. 2) We hope that students keep abreast of current situations and developments at home and abroad in their fields of study. In other words, we hope that they keep abreast of the direction of scientific development in their own fields. 3) We demand that students master correct scientific research methods and techniques and gradually improve their comprehensive thinking ability.

D. In institutions of higher education, training of graduate students should be closely combined with scientific research work of departments and research institutes to promote and supplement each other. Graduate students should be allowed to take part in various domestic academic activities and meetings, absorb special skills of all fields in practice, learn about the scientific research style of all fields and take in everything to accelerate their development. Regarding some vertical disciplines, it is possible for graduate students to study by following certain tutors. But, as far as comprehensive horizontal disciplines and applied sciences are concerned, the limitation of tutors' field of study can make students "undernourished" and hinder their all-round development.

E. In order to develop in an all-round way -- morally, intellectually and physically -- and become both red and expert, graduate students must strengthen their political and ideological work in addition to required political theory courses. Competent young and middle-aged teachers should be assigned as full-time or part-time political instructors for graduate students, especially in research classes.

12302
CSO: 4008/368

XINJIANG: NATIONAL SHELTER-FORESTS SYMPOSIUM ENDS

HK051033 Urumqi Xinjiang Regional Service in Mandarin 1300 GMT 31 Aug 84

[Text] The national on-the-spot symposium on farmland shelter-forests in irrigated areas in northeast, north, and northwest China concluded in Hotan yesterday afternoon.

The symposium held: Hotan Prefecture has made very great achievements in building farmland shelter-forests which break the force of wind and sand and protect and enlarge the oases.

The symposium emphasized: We must attack importance to and popularize Hotan's experiences in line with local conditions. Over the past 5 years, leaders at all levels in Hotan Prefecture have led people of all nationalities to plant trees in the countryside and on sandy beaches and sandy land to break the force of wind and sand and to transform nature. From 1979 to 1983, the whole prefecture planted trees on 239,000 mu each season and fulfilled the first-phase task of building shelter-forests in northeast, north, and northwest China 2 years ahead of schedule.

In summing up the symposium, Dong Zhiyong, vice minister of forestry, said: People of all nationalities in Hotan Prefecture have accumulated rich experiences in the course of building farmland shelter-forests, which can be summarized into five points:

1. Leaders have treated the matter as important, have had great determination, have adopted effective methods, and have aroused the masses' enthusiasm for afforestation.

2. Hotan Prefecture has the spirit of starting an undertaking.

3. Hotan Prefecture has formulated a good plan with a clear target and with clearcut characteristics.

4. Hotan Prefecture has laid stress on scientific afforestation and has raised economic results.

5. Hotan Prefecture has grasped the protection of farmland shelter-forests firmly and well.

Dong Zhiyong emphatically said: To learn from Hotan's experiences, we must have the work style of plain living, hard struggle, being firm and indomitable, and working in a down-to-earth manner, must not seek undeserved reputations, must not do things perfunctorily and superficailly, and must ensure that all shelter-forests grow well.

CSO: 4008/23

NEI MONGGOL REPORTS PROGRESS IN AFFORESTATION

OW021415 Beijing XINHUA in English 0639 GMT 2 Sep 84

[Text] Beijing, 2 Sep (XINHUA)--Arid Inner Mongolia in north China has brought more than 570,000 hectares of land under trees so far this year, 72 percent more than the annual target.

Another 200,000 hectares are expected to be afforested in October as part of a mammoth tree planting program.

Since 1982, the region has encouraged both individuals and collectives to plant trees. While the state effort continues, management of forests is allowed to be undertaken on a household basis.

The region has clearly stipulated that those who plant the trees are entitled to own them and free to dispose of the products. Trees planted by individuals can be inherited or transferred.

In addition, the region has allocated 2.13 million hectares of barren hillsides, wasteland, desert and riversides to local herdsmenand peasants for planting trees.

It has also transferred the right of management of 447,000 hectares of collective-owned trees to individual households and contracted out 577,000 hectares of secondary forests to be managed by villages or individual families.

Similar policies and practices are being adopted in many parts of China to encourage afforestation.

According to another report, Chengde Prefecture in north China's Hebei Province had sown 11,000 hectares to grass by the end of July, overfulfilling its annual plan by 59 percent.

The move is expected to play an important part in checking the degeneration and desertification of local grasslands.

CSO: 4010/10

LIAONING STEPS UP POLLUTION CONTROL MEASURES

OW040837 Beijing XINHUA in Englisn 0756 GMT 4 Sep 84

[Text] Shenyang, 4 Sep (XINHUA)--The heavily industrial center [as received] of Liaoning Province is spending 400 million yuan this year on measures to counter pollution.

The provincial environmental protection department said a similar sum would be spent annually over the next few years. It is four times the annual figure spent on clean-up measures over the past 10 years.

As a result, water and air pollution have been cut sharply. Fish, shrimps and crabs have returned to the Dalian bay, where the average content of oil in the water has dropped from 0.1 milligram per liter in 1980 to the present 0.07 milligrams.

Liaoning has completed 2,249 anti-pollution projects since 1972. As a result, 500 million tons of waste water can be treated annually--a quarter of the province's total. One hundred billion cubic meters of waste gas can be treated, together with 23 million tons of slag.

More than 1,100 electroplating factories and workshops have been merged into 513, reducing discharge of pollutant by 1.6 million tons a year.

Forty-three percent of the province's 25,700 boilers have been upgraded to cut smoke discharge. The city's central heating systems have been extended to increase the housing area they service by 20 million square meters of floor space and this has made it possible to discard 1,500 boilers.

Special groups have been set up in the cities of Shenyang and Fushun to take charge of pollution control in the Hunhe river, one of the worst polluted rivers in the province.

Plants shall be fined for causing pollution, and anti-pollution devices are installed in all new factories.

CSO: 4010/10

SMALL TOWNS CONTROL INDUSTRIAL POLLUTION

OW220534 Beijing XINHUA in English 0241 GMT 23 Sep 84

[Text] Beijing, 22 Sep (XINHUA correspondents)--Industrial pollution is a major problem China's burgeoning rural towns are tackling in the course of expanding themselves.

On a recent trip to Jiangsu and Zhejiang we found both encouraging cases of successful control and energetic efforts to combat pollution and alarming examples of damage it had caused as industry kept growing in the vast countryside.

On the whole the efforts of the government and people to fight pollution were winning, slowly but steadily.

One striking success we noticed is the protection of vital water resources.

An example is the 200 square kilometer-lake Jianhu in Shaoxing, northern Zhejiang, whose water is classified as pure, good enough for making the famous Shaoxing rice wine, one of the area's most important export items.

This success is attributed to a local government decree published in 1981 which forbade the building of factories causing industrial pollution of any kind in 23 towns round the lake.

In southern Jiangsu, the focus of attention is lake Taihu. The 2,420 square kilometer lake--China's third largest--is the lifeline for the Yangtze river delta encompassing the richest part of Jiangsu and Shanghai.

A provincial government decree published in 1982 designated for special protection the land within five kilometers of the banks of the lake and a section of ten kilometers upstream of the rivers emptying into the lake, where dumping of industrial waste and building of factories causing pollution are strictly forbidden.

Repeated tests show that only about one percent of the water of lake Taihu is slightly pollued while the rest continues to be drinkable as ever.

Protection of vital resources is relatively easy, officials say, because it is too important to be ignored.

But it is much more difficult to deal with smaller factories--both collective and private--because they are too scattered.

We had a collection of stories about pond fish being poisoned to death, people suffering from nerve-breaking noises from factories in their neighborhood, and buildings in danger of collapsing because of exposure to air pollution.

"The foul smell from polluted rivers and ponds is now a 'land mark' for some rural towns," said one Zhejiang environmental official. "Shut your eyes and just sniff--you'll know where you are."

Yueqing County has thousands of private workshops producing hardware and simple electrical gadgets and most of them have electroplating machines. The deadly poisonous sewage used to be dumped without treatment--sometimes right into rivers.

Owners of these workshops were repeatedly urged to start treatment facilities but few responded, according to Zhu Huilan, an official in charge of environmental protection.

"Most of the family workshop owners just couldn't afford to buy such facilities and even if they could, they don't know how to use them," she explained.

An alternative had to be found.

With the help of the county bureau of urban and rural construction and environmental protection, Zhu said, a government factory spent 30,000 yuan to build a "mobile sewage treatment plant"--a motorized tricycle fitted with a machine using activated carbon to separate nyanic cadmium from the electroplating effluents.

Family workshops are ordered to keep their sewage in jars to be collected and treated by the "mobile plant" which visited them regularly. "The 'plant' is operating on a non-profit basis," Zhu added.

Officials say that peasant workers need concrete help like this.

In Wuxian County, Jiangsu Province, environmental protection experts have helped phosphorus fertilizer factories devise a technological process to recycle a chemical substance from their waste. The stuff will then be used to treat electroplating sewage, separating cadmium--a heavy metal--from it. Cadmium residue produced in the process is then sold to chemical factories to produce a polishing paste, which is indispensable for electroplating.

"People are becoming more cooperative now that they recognize that we are working in their interest," said Qian Guojun, a local environmental protection expert.

While mass education is the key to the success of the work, compulsory measures are sometimes imperative to bring reluctant people in line.

Three printing and dyeing mills in a small town in Shaoxing County together built a plant to treat their own sewage on orders from the county authorities. At first, said a local environmental protection specialists, they started the facility when inspectors came and shut it off after the inspectors left.

It was only after the mills were made to pay a fine of 8,000 yuan that they began to take pollution control seriously.

"Persuasion is effective only when supplemented by necessary penalties," Xie Xingua, the environmentalists, said.

While traveling in both provinces, we noticed that laws and decress on environmental protection were being made known to the general public through community bulletin boards, posters, and radio stations in small towns, villages and factories.

Oen poster showed crops and forests ruined by acid rain and fish killed by water pollution. The caption read:

"For the sake of your own happiness and the happiness of the generations to come, please cooperate in environmental protection."

CSO: 4010/10

PROGRESS MADE IN BUILDING 'GREEN GREAT WALL'

OW291424 Beijing XINHUA in English 1251 GMT 29 Sep 84

[Text] Yinchuan, 29 Sep (XINHUA)--The first-phase target for building the "green great wall" has been 75 percent completed, a project official said today.

The "green great wall" is a network of environmental protection belts now being built, which will eventually stretch 7,000 kilometers from China's northeast to the northwest through its north.

Protection belts of 4.4 million hectares have been planted in the past six years, shielding 6.67 million hectares of farmland subjected to ravages of sandstorms and water and soil erosion. The first-phase tree-planting task planned for completion in 1985 will cover 5.94 million hectares, according to Chen Guangwu, deputy director of the bureau in charge of the project.

In addition, Chen said, aerial seeding has been done on 80,000 hectares. Hills and mountain slopes of 370,000 hectares have been cordoned off for special protection, where grazing and felling of trees are strictly forbidden.

The "green great wall" will snake its way through areas subjected to serious water and soil erosion in Heilongjiang, Jilin, Liaoning, Hebei, Shanxi, Shaanxi, Gansu and Qinghai provinces, the Beijing municipality, and the Inner Mongolia, Ningxia Hui and Xinjiang Uygur Autonomous Regions.

Nearly 400 counties--about one fifth of the nation's total--will be involved in the project now underway in accordance with a State Council decision in November 1978.

CSO: 4010/10

APPLIED SCIENCES

INCREASED RESEARCH EFFORT IN ANTARCTICA

Oslo AFTENPOSTEN in Norwegian 5 Oct 84 p 8

[Article by AFTENPOSTEN correspondent Gunnar Filseth: "Interest Awakened: China on the Frozen Continent"]

> [Text] Beijing, 4 October. Now the Chinese are also entering the Antarctic. Next month a large expedition will leave to build China's first research base there. Over 100 Chinese scientists will go out on the ice.

A summer station will be set up this time. Beijing observers expect, however, that it is only a question of time before the Chinese will be there in the Antarctic on a year-round basis. This indicates a strongly increasing interest by the Chinese in the frozen continent.

Chinese Antarctic research is rather new, but very determined. The beginning was in 1980, when the first two Chinese polar scientists departed as members of an Australian expedition.

During the past 3 years 30 more have followed. The Chinese have gone as apprentices in stations and expeditions from New Zealand, United States, Argentina and Chile. But now comes China's first independent expedition, and it is not a small one.

Three years ago China formed a national committee for Antarctic research, and last year Beijing joined the Antarctic Treaty--provisionally, with only a kind of associate membership. But observers believe that the Chinese are aiming for a full membership in the "Antarctic Club" similar to countries which have large stations or old territorial claims--as for example Norway, United States and the Soviet Union.

Stepping up their research input would give China an equal status--which in the next phase could expand to a broader development of research activity and participation in the utilization of Antarctic riches in the future.

The group of over 100 scientists are departing aboard a research ship and a salvage ship on 20 November. They will work in marine hydrology, meteorology, geology and geophysics, among other things.

China has not disclosed where the first base will be situated. It has been suggested that they are considering establishing it on the Antarctic Peninsula within the British Falkland sector.

That is an area in which Great Britain, Argentina and Chile have conflicting territorial claims. But these claims are "at rest," at least until 1991 in conformity with the Antarctic Treaty which says that the Antarctic will be a continent for peaceful research and international cooperation.

An official Chinese spokesman said that the purpose of the expedition is to make a Chinese "contribution to mankind's peaceful utilization of the Antarctic. China is prepared for active participation to advance international cooperation in Antarctic research, and to protect the ecological system."

Observers believe that one of the motives may also be the Antarctic's presumed great mineral riches and fishing stocks--something which has caused 12 other nations to establish over 30 year-round bases there. Now the nation which, with its population, has potentially the greatest need for the resources, is entering the picture.

Some of the background for China's growing interest was perhaps also revealed when PEOPLE'S DAILY wrote a while ago, "According to provisional findings, the Antarctic is rich in oil, gas, rare metals, whales and shrimp. At the same time it is a natural research laboratory."

The fact that the Soviets have steadily increased their involvement in the Antarctic may have also played a part. The Russians have year-round stations spread over the entire continent. The Chinese are determined to do something in order not to be completely left behind, said an observer.

Countries in the third world have criticized the Antarctic Treaty and have called the signatory powers a club which was formed to reserve the resources of the continent for their own use. As one of the leaders of the third world, China has to also tolerate a certain amount of criticism for having joined the "club." Malaysia has taken the initiative to get the UN to do something to totally internationalize Antarctica.

For the time being there has been no Norwegian-Chinese cooperation in this area. Norway is "keeping the channels open" in case the Chinese should be interested in closer contacts, the Norwegian Embassy reports. China has not responded to a Norwegian offer of lease of a research ship.

9287
CSO: 3639/7

BRIEFS

U.S. ENVIRONMENTAL COOPERATION--Beijing, 29 Sep (XINHUA)--Minutes of talks on cooperation between China and the United States in environmental research was initialled here today. The research will cover subjects such as environment and health, environmental pollution control, environmental management, and environmental processes and influence. The two sides have attained fruitful results in research into the effect of coal-burning pollution on human beings, under a Sino-U.S. agreement on scientific and technological cooperation in environmental protection signed in 1980. The minutes were worked out by Chinese and U.S. enrivonment protection delegations. The U.S. delegation, headed by Alvin Alm arrived in China on September 19. [Text] [Beijing XINHUA in English 1912 GMT 29 Sep 84]

BEIJING NOISE, POLLUTION BAN--Beijing, 15 Sep (XINHUA)--Three-wheeled motor vehicles notorious for their emission of black clouds of smoke and earsplitting racket, are being banned from Beijing's streets in a concerted effort to solve the Chinese capital's pollution problem. The city's 14,700 trishaws, used to transport passengers and cargo, are being replaced by new-type goods vans. As part of the drive to make Beijing a quieter and cleaner place, motor vehicles have been forbidden to sound their horns except in an emergency since last June. Loudspeakers installed along the main roads have been dismantled, and heavy-duty trucks and tractors have been banned from entering the city. The result has been a lowering of traffic noise by 6 decibels since mid-year, according to the Beijing Environmental Protection Bureau. [Text] [Beijing XINHUA in Englsih 1844 GMT 15 Sep 84 OW]

NEI-MONGGOL AFFORESTATION ACHIEVEMENTS--Over the past 35 years since the PRC's founding, Nei Monggol Autonomous Region has scored marked achievements in planting trees. As of now, the region has increased its percentage of forest cover from 7.7 percent in the early stage of liberation to 13.26 percent at present. At the end of 1980, the acreage of well-maintained forests in the region reached over 28 million mu, a more than 30-fold increase over the figure of the early stage of liberation. During the 1979-1983 period, the region planted more than 31.6 million mu of trees, a 56.5 percent increase over the total acreage of forests planted in the 5-years period before the 3d Plenary Session of the 11th CPC Central Committee. As of now, the region has 95,000 households engaged in afforestation tasks. The region ranked the first in planting trees in the country in 1983. It is expected to plant 10 million mu of trees this year. [Excerpts] [Hohhot Nei Monggol Regional Service in Mandarin 1100 GMT 30 Aug 84 SK]

HUBEI ANALYSIS, MEASUREMENT CENTER--The Hubei Provincial Combined Analysis and Measurement Center was established in Wuchang this morning. The center will carry out its work with precision instruments. The province has a force of some 1,000 analysis and measurement people and precision instruments whose value is approximately 30 million yuan. The center will maintain close ties with all scientific units in Wuhan, will tap their potential, and will provide services to the departments of industry, agriculture, medicine, public health, and national defense. [Summary] [Wuhan Hubei Provincial Service in Mandarin 1100 GMT 8 Oct 84 HK]

CSO: 4008/24

PRC PHARMACEUTICALS CONTROL LAW

OW280353 Beijing XINHUA Domestic Service in Chinese 0811 GMT 21 Sep 84

[Text] Beijing, 21 Sep (XINHUA)--The Pharmaceuticals Control Law of the People's Republic of China

Approved by the Seventh Session of the Sixth NPC Standing Committee on 20 September 1984

Chapter I: General Provisions

Article 1. This law is instituted for the purpose of strengthening the supervision and control of pharmaceuticals, ensuring their quality, enhancing their medical effectiveness, ensuring their safe use, and safeguarding the people's health.

Article 2. The public health administrative department under the State Council is responsible for the nationwide supervision and control of pharmaceuticals.

Article 3. The state shall develop modern and traditional medicines and make full use of medicines in disease prevention, treatment, and health care.

The state shall protect wild herbal medicinal resources and encourage the cultivation of traditional Chinese medicinal materials.

Chapter II: Management of Enterprises Producing Pharmaceuticals

Article 4. Enterprises producing pharmaceuticals must acquire "Pharmaceuticals Production Enterprise Licenses" after being examined and approved by the department responsible for the production and marketing of pharmaceuticals and the public health administrative department in the province, autonomous region or municipality directly under the central government where they are located.

Industrial and commercial administrative departments shall not issue business licenses to enterprises without "Pharmaceuticals Production Enterprises Licenses."

"The Pharmaceuticals Production Enterprise License" shall have a stipulated period of validity to be renewed after examination when it expires. Specifics in this regard shall be stipulated by the public health administrative department of the State Council.

Article 5. Pharmaceuticals production enterprises must meet the following conditions:

(1) Have pharmacists or technical personnel equivalent to or higher than assistant engineer, and skilled workers suitable for the medicines being produced.

Enterprises processing traditional Chinese prepared herbal medicine in small pieces ready for decoction shall have pharmaceutical personnel who are well versed in the property of the medicine being produced and are registered with the public health administrative department at the county level or higher if they are not provided with pharmacists or technical personnel equivalent to or higher than assistant engineer.

(2) Have the factory buildings, facilities and sanitary environment suitable for the production of medicine.

(3) Have the organs, personnel and required instruments and equipment for inspecting the quality of medicines being produced.

Article 6. Pharmaceuticals must be manufactured in accordance with technological regulations, and production records must be complete and accurate.

The process of preparing ready-to-decoct Chinese medicine shall conform to stipulations of the "Pharmacopoeia of the People's Republic of China" or the "Standards for Processing Medicine" formulated by the provincial, autonomous regional of municipal public health administrative departments.

Article 7. The raw materials, supplementary materials for medicine production, and the containers and packing materials that come in direct contact with medicines shall conform to the requirements for medical use.

Article 8. Pharmaceutical products must go through quality inspection before leaving the factory; products which do not meet the standards shall not leave the factory.

Article 9. Pharmaceutical production enterprises must formulate and enforce rules and regulations and sanitary requirements for ensuring quality medicine in accordance with the "Standards for Quality Control of Pharmaceutical Products" formulated by the public health administrative department of the State Council.

Chapter III: Management of Enterprises Marketing Pharmaceuticals

Article 10. Enterprises marketing pharmaceuticals must acquire "Pharmaceuticals Marketing Enterprise Licenses" after being examined by the local competent department responsible for the marketing of pharmaceuticals and verified and approved by the public health administrative department at the county level or higher.

Industrial and commercial administrative departments shall not issue business licenses to enterprises without a "Pharmaceuticals Marketing Enterprise License."

"The Pharmaceuticals Marketing Enterprise License" shall have a stipulated period of validity to be renewed after examination when it expires. Specifics in this regard shall be stipulated by the public health administrative department of the State Council.

Article 11. Enterprises marketing pharmaceuticals must meet the following conditions:

(1) Have pharmaceutical technical personnel corresponding to the medicines being marketed.

Enterprises selling traditional Chinese medicine and enterprises that sell medicine on the side shall have pharmaceutical personnel who are well versed in the property of medicines being sold and are registered with the public health administrative department at the county level or higher if they are not provided with pharmaceutical technical personnel.

(2) Have the space, equipment, storage facilities, and sanitary environment required for the medicines being sold.

Article 12. In purchasing pharmaceuticals, quality inspection must be carried out before acceptance. Pharmaceuticals which do not meet the required standards must not be purchased.

Article 13. In selling pharmaceuticals, it is mandatory to be accurate and free of error. It is also necessary to provide correct directions, dosages and warnings. Prescriptions must be checked before being processed. Pharmaceuticals listed in prescriptions must not be presumptuously changed or replaced. Processing should be denied for prescriptions containing incompatible substances or overdosages. If necessary, these prescriptions can be processed after they have been corrected or re-signed by the doctors making the prescriptions.

Herbal medicines for sale must be clearly marked with their place of production.

Article 14. Pharmaceutical storaging systems must be formulated and implemented for pharmaceutical warehouses, while cold storage, moisture-, insect- and rat-prevention, and other necessary measures must also be adopted.

Inspection must be carried out on pharmaceuticals entering or leaving the warehouse.

Article 15. Except for those specified by the state, both urban and rural country fair markets are allowed to sell herbal medicines.

Except for those holding a "Pharmaceuticals Management and Enterprise Permit," no urban or rural country fair market is allowed to sell pharmaceuticals which do not belong to the category of herbal medicines.

Chapter IV: Control of Pharmacy at Medical Units

Article 16. Medical units must be staffed with pharmacological personnel, who are compatible with their tasks. Nonpharmacological personnel are not allowed to engage directly in pharmacological work.

Article 17. To engage in the preparation of medicines, medical units must be examined, approved and issued a "Pharmacy Permit" by the public health administrative departments of their respective provinces, autonomous regions, or central-government-controlled cities.

"Pharmacy Permits" should be specified with a validity date, and reexaminations should be carried out before reissuing permits. Specific methods will be stipulated by the State Council's public health administrative department.

Article 18. To engage in the preparation of medicines, the medical units must be equipped with the facilities, inspection instruments, and sanitary conditions, which guarantee the quality of the preparations.

Article 19. The medicines prepared by the medical units must be based on clinical needs, and their quality must be inspected according to rules. The medicines passed by the inspection can be used according to doctors' prescriptions.

The medicines prepared by medical units must not be sold at the market.

Article 20. In purchasing pharmaceuticals, the medical units must implement the quality inspection and acceptance systems.

Chapter V: Control of Pharmaceuticals

Article 21. The state encourages research and manufacture of new pharmaceuticals.

To engage in the research and manufacture of new pharmaceuticals, it is mandatory to submit research and manufacturing methods, quality indices, pharmacological and toxicological testing results, and other related materials and samples to the State Council's public health administrative department, or to the public health administrative departments of the provinces, autonomous regions and central-government-controlled cities, according to regulations. Clinical tests, or clinical verifications, can be carried out only after approval.

On completion of their clinical tests, or clinical verification, and their appraisal, new pharmaceuticals will be issued certificates, if they are approved by the State Council's public health administrative department.

Article 22. Production of new pharmaceuticals can be carried out only with approval from the State Council's public health administrative department, and issue of the approval document number. However, this does not apply to the production of herbal medicines already prepared in small pieces for decoction.

Production of pharmaceuticals, for which there are state standards, or provincial, autonomous regional and central-government-controlled city standards, can be carried out only after it is examined, approved, and given the number of the approval document by the provincial, autonomous regional, or central-government-controlled city public health administrative departments, with the concurrence of the departments in charge of the production and management of the pharmaceuticals of the same grade. However, this does not apply to the production of herbal medicines already prepared in small pieces for decoction.

Article 23. Pharmaceuticals must meet the state pharmaceutical standards, or the provincial, autonomous regional and central-government-controlled city pharmaceutical standards.

The "PRC Pharmacopia" and pharmaceutical standards promulgated by the State Council's public health administrative department are the state pharmaceutical standards.

The pharmacopia committee of the State Council's public health administrative department is responsible for organizing the formulation and revision of state pharmaceutical standards.

Article 24. The State Council's public health administrative department, and the provincial, autonomous regional, and central-government-controlled city public health administrative departments may establish committees for examination and appraisal of pharmaceuticals to carry out examination and appraisal of pharmaceuticals to carry out examination and appraisal of new pharmaceuticals and reappraisal of finished pharmaceutical products.

Article 25. The State Council's public health administrative department must organize inspection of pharmaceuticals for which production has been approved; and it must revoke the approval numbers of those pharmaceuticals whose curative effects are uncertain, which have harmful side effects, or which are hazardous to people's health because of various other reasons.

Production and sale of pharmaceuticals, whose approval numbers have been revoked, must not continue; and those which have been produced must be destroyed, or handled under supervision of the local public health administrative departments.

Article 26. Pharmaceuticals, whose curative effects are uncertain, or which have harmful side effects, or which are hazardous to people's health, shall not be imported.

Article 27. For pharmaceuticals which are imported for the first time, the importer must provide the manuals, quality, methods of inspection, and other

relevant information and samples, as well as the exporting countries' (or regions') documents certifying approval of their production, and import contracts can be signed only when the approval of the State Council's public health administrative department has been obtained.

Article 28. Imported pharmaceuticals are subject to inspection by pharmaceutical organs authorized by the State Council's public health administrative department; and only those which have passed inspection can be imported.

Import formalities for small quantities of pharmaceuticals imported by medical units for urgent clinical needs, or imported for personal use, must be handled according to the customs regulations.

Article 29. The State Council's public health administrative department has the authority to restrict, or ban, the export of Chinese medicinal materials or patented Chinese medicines, which are in short supply at home.

Article 30. "Import licenses" or "export licenses" issued by the State Council's public health administrative department are required for importing or exporting narcotics and mental drugs [jing sheng yao pin 4737 4377 5522 0756] falling within the scope prescribed by the State Council's public health administrative department.

Article 31. Newly discovered medicinal materials or medicinal plants from abroad can be marketed only when they have been examined and approved by a public health administrative department of a province, an autonomous region, or a municipality directly under the central government.

Article 32. Specific measures for controlling regional folk medicines will be formulated by the State Council's public health administrative department.

Article 33. Production and marketing of bogus medicines is prohibited. A medicine is considered bogus if it is any one of the following:

a) The names of the ingredients of a drug are different from those prescribed for drugs by the state, province, autonomous region, or municipality directly udner the central governmnet.

b) A nonmedical substance being passed off as a drug, or a drug being passed off as a different drug.

Drugs belonging to any one of the following will be handled as bogus drugs:

a) Drugs banned by the State Council's public health administrative department.

b) Drugs produced without approval.

c) Drugs which have been contaminated, and cannot be used as drugs.

Article 34. Production and marketing of drugs of inferior quality is prohibited. Any one of the following shall be considered as a drug of inferior quality:

a) A drug, whose medical contents are different from the standards prescribed for pharmaceuticals by the state, or by a province, autonomous region, or municipality directly under the central government.

b) A drug which has passed its expiration date.

c) Any other drug not meeting the prescribed standards for pharmaceuticals.

Article 35. Personnel of the enterprises producing or trading pharmaceuticals, and personnel of medical units, who have direct contacts with pharmaceuticals, must have an annual health examination. People who have contagious diseases, or other diseases which may contaminate medicines, must not take up work which has direct contact with pharmaceuticals.

Chapter VI: Packing and Dispensing of Pharmaceuticals

Article 36. The packing of pharmaceuticals must meet the specific requirements of the different quality pharmaceuticals in order to facilitate storage, transportation, and medical treatment. Pharmaceuticals with a validity date must be indicated on the outside of the package.

Chinese herbal medicines must be properly packed before transportation. On the outside of the package must be indicated the name of the pharmaceutical, place and date of production, the dispensing unit, attached with a quality label.

Article 37. In accordance with the rules and regulations, packing of pharmaceuticals must include a label and directions for use.

The name, specifications, production enterprise, approval number, product number, ingredients, curative effects, directions, disages, contraindication, harmful side effects, and warnings must be indicated on the label or in the directions.

Special indications must be shown on the labels of narcotics, sedative medicines [jing sheng yao pin 4737 4377 5522 0756], toxic pharmaceuticals, radioactive pharmaceuticals and pharmaceuticals for external use.

Article 38. Pharmaceutical enterprises must possess the necessary dispensing equipment, hygienic conditions and qualified pharmacological personnel for dispensing work. The dispensation records must be complete and correct.

The dispensed pharmaceuticals must contain directions for use, indicating the name, specifications, production enterprise, product number, dispensing unit, and dispensing number on the package. The validity date of specified pharmaceuticals must be clearly indicated on the package after dispensing.

Chapter VII: Pharmaceuticals under Special Control

Article 39. The state adopts special measures for the control of narcotics, sedative medicines, toxic pharmaceuticals, and radioactive pharmaceuticals. The control measures are to be formulated by the State Council.

Article 40. Narcotics, including plants, must only be produced by units assigned by the State Council's public health administrative department, and other concerned departments. The supply of narcotics by the assigned units must be various provinces, autonomous regions, and municipalities directly under the central government, and other concerned departments.

Chapter VIII: The Control of Labels and Advertisements for Pharmaceuticals

Article 41. Except for Chinese herbal medicines, and prepared herbal medicines in small quantities, all pharmaceuticals must have registered trademarks. Unregistered pharmaceuticals must not be put on sale in markets.

The registered trademark must be shown on the package or label.

Article 42. Advertisements for pharmaceuticals must be examined and approved by the public health administrative departments of the various provinces, autonomous regions and municipalities directly under the central government. No advertisements for pharmaceuticals must be published, aired, disseminated, or pasted up on walls without approval.

Article 43. In applying for pharmaceuticals advertisements, a foreign enterprise must submit the relevant documents of approval by the country (or region) in which the pharmaceutical is produced, together with directions foruse, and other relevant materials.

Article 44. The contents of advertisements for pharmaceuticals must be based on the directions approved by the State Council's public health administrative department, or by the public health administrative departments of the various provinces, autonomous regions, and municipalities directly under the central government.

Chapter IX: Supervision of Pharmaceuticals

Article 45. Public health administrative departments, at or above county level, exercise authority for supervision of pharmaceuticals.

The public health administrative departments, at or above county level, can set up pharmaceuticals administrative organs or pharmaceuticals inspection organs.

Article 46. The public health administrative departments, at or above county level, can appoint pahrmaceuticals supervisors. Pharmaceuticals supervisors must be appointed from among pharmacological personnel, and are issued certificates by the people's government at the same level.

Article 47. In accordance with regulations, the pharmaceutical supervisors are authorized to exercise supervision, inspection, sampling, and if necessary request for samples and relevant data from pharmaceuticals production enterprises, pharmaceuticals management enterprises and medical units under their jurisdiction. The concerned units must not reject such requests, nor attempt to cover up relevant data. Pharmaceutical supervisors are responsible for keeping secret the technological data provided by the pharmaceuticals production enterprises and the scientific research units.

Article 48. Pharmaceuticals production enterprises, pharmaceuticals management enterprises, and medical units must frequently conduct inspection on quality, curative effects and harmful side effects of pharmaceuticals under their production, management or disposition.

On discovery of poisoning by pharmaceuticals, the medical units must promptly report to the local public health administrative departments.

Article 49. Pharmaceuticals test and inspection organs, or personnel of the pharmaceuticals production enterprises and the pharmaceuticals management enterprises, must receive operational guidance from the local pharmaceuticals test and inspection organs.

Chapter X: Legal Responsibility

Article 50. Bogus medicines and illicit incomes from the production and marketing of bogus medicines must be confiscated, and the concerned units must be fined, suffer suspension of production, suspension of operations for consolidation, or revocation of the "pharmaceuticals production enterprise permit," the "pharmaceuticals management enterprise permit," and the "pharmacy permit."

Criminal responsibility must be pinned on those units or individuals directly engaged in the production and marketing of bogus medicines harmful to people's health, in accordance with the provision set out in Article 164 of the Criminal Law.

Article 51. Bogus medicines and illicit incomes from the production and marketing of bogus medicines must be confiscated, and the concerned units can also be fined. In serious cases, the concerned units must be ordered to suspend production and operations, or have their "pharmaceuticals production enterprise permit," "pharmaceuticals management enterprise permit," and "pharmacy permit" revoked.

Criminal responsibility must be pinned on those units or individuals directly engaged in the production and marketing of bogus medicines harmful to people's health and causing serious consequences, in accordance with the provinsions set out in Article 164 of the Criminal Law.

Article 52. Units which engage in the production, management, and preparation of medicines without the "pharmaceuticals production enterprise permit," the "pharmaceuticals management enterprise permit" and the "pharmacy permit," must be ordered to suspend production, operation or preparation of medicines, and have all their pharmaceuticals and illicit incomes confiscated. Fines can also be imposed on such units.

Article 53. Warnings must be issued, or fines imposed, on those units which violate this law on the production of pharmaceuticals or other provisions for the management and control of pharmaceuticals.

Articale 54. The administrative punishments stipulated in this law are to be decided by the public health administrative departments, at or above county level. The administrative punishments for violation of Article 15 of this law, or for violation of Chapter VIII on control of advertisements, are to be decided by the industrial and commercial administrative departments.

Suspension of production, or suspension of operations for 7 days or above, or revocation of the "pharmaceuticals production enterprise permit" and "pharmaceuticals management enterprise permit" of the pharmaceuticals production enterprises and pharmaceuticals management enterprises under the jurisdiction of the central government or the various provinces, autonomous regions and municipalities directly under the central government, are to be reported by the public health administrative departments of the various provinces, autonomous regions and municipalities directly under the central government to the same level of the people's governments for decision. Suspension of production, or suspension of operations for 7 days or above, or revocation of the "pharmaceuticals production enterprise permit" and "pharmaceuticals management enterprise permit" of the pharmaceuticals production enterprises and the pharmaceuticals management enterprises under the jurisdiction of the people's governments, at or below city and county level, are to be reported by the public health administrative departments of the city and county people's governments to the same level of people's governments for decision.

The confiscated pharmaceuticals are to be supervised and disposed of by the public health administrative departments.

Article 55. The party concerned, which refuses to accept administrative punishment, must bring the case to the people's court within 15 days of receipt of notice on punishments. However, the party concerned must immediately carry out the decision by the public health administrative department on the control of pharmaceuticals. The organ, which made the decision on administrative punishments, must apply to the people's court for compulsory execution, should the party concerned fail to comply with the punishments, and bring the case to the people's court within the above time limit.

Article 56. The units or individuals concerned, who have caused pharmaceutical poisoning in violation of this law, must bear responsibility for compensation. The victims can request public health administrative departments, at or above county level, for handling. The party concerned, which refused to pay compensation, can bring the case to the people's court.

Request for compensation must be presented by the victim, or its advocate, within a year from the day of knowing or assumed to have known the damage done. Request for compensation will not be handled after the time limit of a year.

Chapter XI: Supplementary Articles

Article 57. Meaning of Certain Words Used in This Law:

Pharmaceutical--A pharmaceutical means a substance used in preventing, treating, or diagnosing human diseases, or in purposely regulating human physiological functions. A pharmaceutical must bear instructions with regard to its usage, directions for use, and dosage. Pharmaceuticals include medicinal herbs, prepared herbal medicine in small pieces ready for decoction, prepared traditional Chinese medicine, medicinal chemicals and their preparations, antibiotic, biochemical medicine, radioactive medicine, serum vaccine, blood products and diagnosing medicine.

New pharmaceutical--a new pharmaceutical means a pharmaceutical that has not yet been produced in China.

Supplementary material--Supplementary materials denote the excipients and additives used in producing pharmaceuticals or in preparing prescriptions.

Pharmaceuticals producing enterprise--A pharmaceuticals producing enterprise is an enterprise that produces pharmaceuticals either as its sole business or in addition to other business.

Pharmaceuticals marketing enterprise--A pharmaceuticals marketing enterprise is an enterprise that sells pharmaceuticals either as its sole business or in addition to other business.

Article 58. The production of pharmaceuticals referred to in this law does not include the cultivation, collection and breeding of the raw materials for traditional Chinese medicine.

Article 59. Implementing measures, based on this law, shall be formulated by the public health administrative department of the State Council and be submitted to the State Council for approval on their implementation.

Regulations governing the management of the specific-need pharmaceuticals of the Chinese People's Liberation Army shall be formulated by the military department in charge.

Article 60. This law comes into force on 1 July 1985.

Addendum:

The Article from the Criminal Law cited in "The Pharmaceuticals Control Law"

Article 164. Anyone who manufactures or sells bad drugs that harm the people's health for the purpose of seeking profits will be sentenced to imprisonment for not more than 2 years, detention, or surveillance; a fine may be imposed concurrently or exclusively. If there are serious consequences, the offender will be sentenced to imprisonment for not less than 2 years and not more than 7 years; a fine may be imposed concurrently.

CSO: 4008/17

EFFECTS OF GAMMA RADIATION OF MAMMALIAN CELL NUCLEUS DNA

Shanghai XIBAO SHENGWUXUE ZAZHI [CHINESE JOURNAL OF CELL BIOLOGY] in Chinese No 3, 1983 pp 18-21

[Article by Sun Zhixian [1327 1807 6343], Wang Huaibin [3769 2037 6333] and Xia Shouxuan [1115 1108 5503], Institute of Radiology,Chinese Military Academy of Medical Sciences]

[Text] DNA is the largest molecule for radiation injuries. But when talking about euckaryote, DNA molecule exist in the cell nucleus as nucleoprotein compound by combining the proteins of the same nucleus (histon and non-histone). Consequently, research which emphasizes the effects of radiation on the entire genome of the euckaryote has become an important topic in current international research on radiobiology.[1] We have observed the effects of radiation on the big rat cell nucleus DNA transcription activity in laboratory experiment. From the chromatin DNA template efficiency and from the RNA synthesis under the catalysis of RNA polymerase as directed by DNA, we have explored the radiation injuries on RNA synthesis, and more particularly on the mechanism for hindering DNA synthesis of the bloodmaking tissue of the spleen.

Material and Method

Animal: male big rat raised by the institute, weighing 160-180 grams Irradition: cobalt $(Co)^{60}$. y-Ray 1,000 rad, dosage rate at 7.51 billion/ min separation of the Cell Nuclei of the Liver, Spleen, and Thymus Gland of Big Rats.

Livers, spleens and thymus glands are taken from both normal and irradiated rats. Purified nuclei are separated using the Widnell & Tata[2] and Chanveau[3] method with the only difference of substituting 2.0M sucrose for heavy sucrose in purifying cell nucleus in 50mM Tris-HCl pH8.0, 25mM KCl, 1mM $MgCl_2$, 0.1 mM dTT, 0.1 mM PMSF (tosyl fluorine) buffer solution at 2^0C and 35,000 rpm to proceed ultracentrifugal activity for 60 minutes. The purified cell nucleus is finally checked by optical microscope.

RNA Polymerase Separated from the Spleen Cell Nucleus of Big Rat

We adopt the Roeder & Rutter[5] method as later revised by Babcock[4] et al.: The purified nucleus is suspended in the buffer solution of 10 mM Tris-HCl

pH7.9, 1.0M sucrose, 5mM $MgCl_2$. 1 mM dTT. 4M ammonium sulphate (pH7.9) is added to the solution which is being stirred constantly to reach a consistency of 0.2M. Then Model KuBOTA 200M ultrasonic instrument is used to do 140 W ultrasound process at 15 second x 8 times. Cyclic cooling temperature is 0^0C. The solution from ultrasound activity is diluted by TGMED (50 mM Tris-HCl pH 7.9, 25 percent glycerine, 5 mM $MgCl_2$, 0.1 mM EDTA and 0.5 mM dTT) under 2°C and to do 18,000 rpm centrifugal separation for 60 minutes. Solid ammonium sulphate is added to supernatant fluid until the final consistency is 75 percent. After ultracentrifugal activity at 35,000 rpm for 40 minutes, the sediment is dissolved in the small volume of TGMED (contraining 50 mM ammonium sulphate)buffer solution. The same buffer solution undergoes dialysis for 8 hours. The next day, ultracentrifugal activity is performed at 35,000 rpm for 60 minutes. The supernatant fluid is the RNA polymerase.

Preparation of the Spleen Chromatin of Big Rats

Following the method of Marshige & Bonner et al.[6], we did a 15-minute centrifugal process at 2°C and 4,500 rpm on the purified spleen cell nucleus in the buffer solution of 75 mM NaCl, 24 mM EDTA (pH8.0) and 0.1 M Sucrose. The centrifugal process is repeated once for the sediment. The solution is being stirred together with 20-fold 10 mM Tris-HCl pH8.0 mild and even solution for 60 minutes under 0°C. Then another centrifugal activity is performed for 30 minutes at 16,000 rpm. The sediment is suspended in the buffer solution of 1.7 M sucrose and 10mM Tris-HCl pH 7.4. Twenty minutes of 35,000 rpm ultracentrifugual activity is performed under 2°C suspended the white chromatin light sol in the 0.1 mM Tris-HCl pH 8.0 buffer solution which, when a centrifugal activity is performed at 16,000 rpm under 2°C for 30 minutes, produces soluble chromatin.

DNA Purification

High polymer DNA can be extracted from the chromatin using Kay's[7] method and then purified using Marmur's[8] method.

RNA Synthesis Activity Determination

The reaction system is identical with the report from Jacob[9] et al. Final volume is 0.4 milliliter containing: 100 mM Tris-HCl pH 7.9, 2 mM $MnCl_2$, 5 mM $MgCl_2$, 0.5 mM dTT, 3.3 mM NaF, 8 mM KCl, and ATP, CTP, and GTP at 0.5 mM each, UTP is 0.1 mM, ^{3}H-UTP luci (specific activity 15 ci/mM); the amount of ammonium sulphate at liti [4418 7555] nucleus RNA synthesis determination is 200 mM; RNA polymerase during activity check is 80 mM; DNA and chromatin template efficiency tests are: 100 mM and 120 mM. Liti [4418 7555] RNA synthesis activity test shows the DNA amount in the nucleus suspending solution (0.32 M sucrose, 0.1 mM dTT, 0.1 mM PMSF) to be 80-100 microgram. The RNA polymerase activity test shows the DNA amount in homogenous normal spleen to be 30 microgram. Usage of RNA polymerase for normal and irradiated spleen is 50 microgram zymoprotein. Template (DNA and chromatin) efficiency test shows that using RNA polymerase (50 microgram protein) as catalyst, the DNA and chromatin template amounts of normal and

irradiated spleen are 30 microgram DNA and 50 microgram DNA respectively. Furthermore, the RNA polymerase activity test shows a 200 microgram/milliliter bovine serum albumin in the reaction system. After a 40-minute water bath at 37°C, the reaction system is put in ice bath, with simultaneous pouring in of 3 milliliters of cold 10 percent TCA (containing 1 percent $Na_4O_2O_7$) and then we end the reaction. Fifty minutes later, under room temperature, we filter out the non-soluble acid material by pore lumo [3459 5229] (0.45 micron aperture, trial manufactured by Shanghai Medical Enginering College). We wash using successively 5 percent TCA 5 milliliters tree times, 60 percent ethyl alcohol 5 milliliters two times, 95 percent ethyl alcohol 5 milliliters once. After drying out by infrared rays, the lumo [3459 5229] is placed in 5 milliliters of toluene liquid scintillator (each liter toluene PPO 4 gram, POPOP 0.1 gram) as determined by Model LKB-1215 liquid scintillometer.

Chemical composition Analysis of Chromatin and Ultraviolent Spectrum Scanning Details for analyzing the chromatin chemical composition are described by the Spelsberg[10] method.

For the determination of DNA by the Burton[11] method, our laboratory uses the DNA of purified veal thymus gland as the standard. For protein, we use the Lowry method as later revised by Shacterle[12]. Bovine serum albumin (prepared by electrophoresis at the Institute of Biophysics) and histore (prepared and purified by our laboratory) are treated as the standard protein.

Chromatin ultraviolent spectrum scanning is done on theBeckman DC model spectrophotometer. The scanning wavelength is 220-340 nm.

Results and Discussion

1. Radiation Sensitivity of the Big Rat's Tissue RNA Synthesis

The experiment first compares the changes in the RNA synthesis abilities of the big rat's liver, spleen and thymus gland at 2, 6 and 24 hours after being exposed to 1,000 rad y-Ray. The synthesis reaction is achieved under external conditions using complete nucleus internal-source DNA as template and internal-source RNA polymerase as catalyst. The result of the experiment is shown in Table 1: Within the first 2 hours of irradiation, when the spleen cells had not suffered any loss, the RNA synthesis rate decreased by 36.8 percent. Twenty-four hours after irradiation, the synthesis rate reduced to 51.8 percent of the normal rate. For thymus gland, there was not any apparent RNA synthesis change within 2 hours of irradiation. But the RNA synthesis rate after 6 and 24 hours after irradiation decreased to 55.4 percent and 37.8 percent of the normal rates respectively. The damage to thymus gland 24 hours after the irradiation is heavier than that to the spleen. This can be explained by the Bergonie-Tribondean Law. As the lymphocyte rejuvenating time is shorter and the proliferation rate is higher in the thymus gland than that in the spleen, the sensitivity to radiation is stronger. Yet how do we explain the fact that little change occurred in the thymus gland RNA synthesis

Table 1

Radiation Sensitivity Comparison of 1,000 y-Ray on Big Rat Tissue RNA Synthesis

Tissue	Hours after irradition	c.p.m/milligram DNA (x 10^3)	Percentage
Spleen	Control	2.25 ± 0.166	100.0
	2	1.42 ± 0.095	63.2
	6	1.26 ± 0.095	55.8
	24	1.17 ± 0.120	51.8
Thymus gland	Control	1.92 ± 0.011	100.0
	2	2.04 ± 0.030	105.0
	6	1.07 ± 0.108	55.4
	24	0.73 ± 0.054	37.8
Liver	Control	5.21 ± 0.102	100.0
	2	6.67 ± 0.116	128.1
	6	9.54 ± 0.183	183.3

Data are the average value from three batches of experiment ± standard deviation. More than six big rats are used in each batch.

after 2 hours of irradiation? According to Tian Niu et al.'s research, the differences in sensitivity to radiation of the spleen and thymus gland tissues should be considered with regard to reactions of single cell group and also to the mutual relationship and effects among cells and tissues. Attention should be paid to the mutual effects of parenchyma and mesenchyme. Their experiment demonstrated that during the early period of irradiation, the injury to thymus gland lymphocyte is lighter than that to the spleen lymphocyte. The reason is because the microcirculation change during the early stage of irradiation is lighter in the thymus gland. Thymus gland contains lymphatic vessels but the lymphsinuses are less developed than those in the spleen. Furthermore, there is space existing surrounding the microblood vessels of thymus gland serving as shelters for the parenchyma cells of the thymus gland, thus slowing down the damage by irradiation. Differing from spleen and thymus gland, the liver RNA synthesis demonstrated resistance to radiation. Two hours after irradiation, the RNA synthesis showed an increase with conforms to the research result in radiation cytology. The increase is thought to be related to the fact that the synthesis of certain proteins in certain nucleuses particularly those specific acid protein syntheses are susceptible to certain selective stimulants.[13].

Injuries to RNA synthesis can be traced to two sources: first, the change in DNA template efficiency which RNA synthesis relies on; and second, the change in RNA polymerase activity which is under the direction of DNA. Considering the liti nucleus RNA synthesis test itself, since reaction proceeded using internal-source template under the catalysis of internal source RNA polymerase, the result of RNA polymerase activity test conforms with the template efficiency. To further explore the effects and mechanism of radiation on DNA transcription activity, we need to study the change in the chromatin DNA template efficiency and in the RNA polymerase activity under the direction of DNA when being affected by radiation.

2. Radiation effects on RNA Polymerase (under the direction of DNA) Activity RNA polymerase under the direction of DNA is the catalyst enzyme for synthesizing RNA. It is an important explorer for research on eucaryon gene expression. Thus, by using homogenous normal spleen DNA as template, we do a RNA synthesis reaction using RNA polymerase as catalysis which have been separated from the big rat normal spleen, and then from the spleens which have undergone 6 hours of irradiation at 1,000 rad. RNA polymerase is arrived at by ultrasound process of diyannong du [0144 7770 3426 1653] solution separating RNA polymerase from DNA followed by ultracentrifugal separation of soluble RNA polymerase holoenzyme. This when used as catalyst for RNA synthesis, can show a more complete picture of the entire radiation effects on RNA synthesis. As shown in Table 2, even though no differences in quantity and quality can be found in the DNA templates used by the normal and the irradiated big rat spleen RNA polymerase, the synthesis reaction under the catalysis of irradiated spleen RNA polymerase showed apparent inhibition in transcription ability. The inhibition effect is probably caused by a lowered level of zymoprotein activity or partial inactivation of the

polymerase itself. It is thus important to do an in-depth study of the function of RNA polymerase in transcription regulation.

Table 2

Comparison of DNA and Chromation Template Activity (cpm/milligram DNA x 103) and RNA Polymerase Activity (cpm/milligram protein x 10) For the Spleen Tissue of Big Rat under Normal Conditions and 6 hours after Irradiation by 1,000 rad Y-Ray

Experiment Group	Normal Spleen	Irradiated Spleen	Inhibition %
RNA polymerase activity	2.24 ± 0.107	0.57 ± 0.01	74.6
DNA template	3.37 ± 0.044	1.73 ± 0.025	48.6
Chromatin template	2.50 ± 0.081	2.07 ± 0.022	17.2

Data in the table are the average value ± standard deviation based on more than three batches of big rat spleens with six in each batch.

Table 3
Ratio between the Chromatin DNA and Protein of Normal and Irradiated Big Rat Spleen

	DNA	Total Protein	Histone	Non-histone
Normal	1.0	1.45 ± 0.04	0.95 ± 0.02	0.43 ± 0.04
Irradiated	1.0	2.53 ± 0.06	1.53 ± 0.03	1.01 ± 0.07

Data in the table are the average value ± standard deviation based on three batches of big rat spleens with six in each batch.

3. Effects of Radiation on Chromatin DNA Template Efficiency

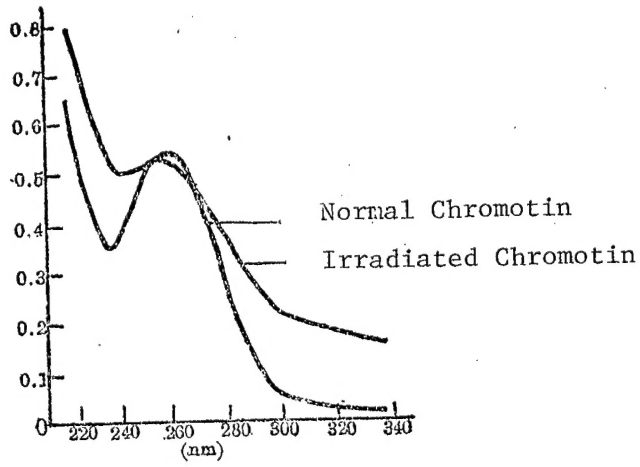
Table 2 shows that in the experiment, identical homogenous catalyst is given to both the normal and the irradiated DNA and chromatin for synthesis reaction. The result shows that the chromatin and the DNA templates have undergone inhibition after irradiation. The inhibition rates are 17.2 percent and 48.6 percent respectively. The decrease in radiated chromatin template efficiency rate is relatively smaller.

This is probably related to the regulation effect of the chromatin protein of the chromatin compound on gene expression.

Table 3 and Graph 1 show the chemical composition analysis and the ultraviolet spectrum scanning of the big rat spleen chromatin (normal and after radiation). After radiation, the ratios between DNA and histone and non-histone and the ultraviolet absorption spectrometry showed apparent change. The changes are mainly reflection on the metabolic obstacle of the synthesis between DNA and protein. Under the condition of the above dosage, the structural change in the chromatin compound is mainly related to the partial crosslinking between the DNA and the protein molecules. The cross-linking effect of chromatin DNA and protein in the nucleus particularly the cross-linking effect between histone and structure inducing nonhistone as caused by radiation has drawn world-wide attention.[1]

The above experiment demonstrated that the bloodmaking organ spleen RNA synthesis is sensitive to Y-Ray radiation. Clear inhibition can be observed in the early stage of radiation. The mechanism for inhibition is partly due to the inactivity or suppression suffered by the RNA polymerase under DNA direction, and partly due to the injury to the transcription function of the DNA template which in turn lowered the template transcription activity.

Graph 1



Normal and Irradiated Big Rat Spleen Chromatin UV Spectrum

Normal spleen chromatin:	220/260 = 1.226
260/280 = 1.650	320/260 = 0.052
Irradiated spleen chromatin:	220/260 = 1.528
260/280 = 1.325	320/260 = 0.368

The damage of the DNA transcription activity in the nucleus is closely related to the DNA template efficiency and the change in the RNA polymerase activity under DNA direction. In conclusion, it is doubtlessly an important step to study the damage of radiation on eucaryote and the law for recovery from an in-depth study of the entire genome, the mutual effect of the genome DNA and non-DNA component (histone, nonhistone, RNA in nucleus) and other factors in the cell.

BIBLIOGRAPHY

1. Sun Zhixian, GUOWAI JUNSHI YIXUE ZILIAO (FANGSHE YIXUE FENCE) [MILITARY SCIENCE ABROAD (RADIOLOGY FASCICLE], No 3, pp 15-29, 1980.
2. Widnel, C.C. and Tata, J.R., BIOCHEMISTRY JOURNAL, pp 313-317, 1964.
3. Chauveau, J. et al., EXPERIMENTAL CELL RESEARCH, No 11, pp 317-321.
4. Babcock, D.F. et al., BIOCHEMISTRY JOURNAL, No 133, pp 797-804, 1973.
5. Roeder, R.G. and Rutter, W.J., PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCE, USA, No 65, pp 675-682, 1970.
6. Marushige, K. and Bonner, J., JOURNAL OF MOLECULAR BIOLOGY, No 15, pp 160-174, 1966.
7. Kay, E.R.M. et al., AMERICAN CHEMISTRY SOCIETY, No 74, pp 1724-1726, 1952.
8. Marmur, J., JOURNAL OF MOLECULAR BIOLOGY, No 3, pp 208-218, 1961.
9. Jacob, S.T. et al. JOURNAL OF BIOCHEMISTRY, No 14, pp 3589-3597, 1978.
10. Spelsberg, T.C. et al., BIOCHEMISTRY BIOPHYSICS ACTA, No 228, pp 202-211, 1971.
11. Burton, K., BIOCHEMISTRY JOURNAL, No 62, pp 315-323, 1956.
12. Schacterle, G.R., ANALYTIC BIOCHEMISTRY, No 51, pp 654-657, 1973.
13. Subba, Rao M.N., FEBS. LETT, No 48, pp 161-169, 1971.

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